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EDITORIAL NOTES.

The Anglo-American Exhibition.

WE seem in connection with the gas industry almost to require a sort of Intelligence Department, controlled by an Advisory Committee—a department that could keep its eye on forthcoming events, ascertain where, if anywhere, the gas industry would be affected, and give counsel as to what movement, if any, the industry should make. In the gas industry, we have been so engrossed lately in our own special exhibition that, until the Chairman of the South Metropolitan Gas Company (Mr. Charles Carpenter, D.Sc.) made his striking speech at the luncheon given by the Metropolitan Gas Companies to the British Commercial Gas Association, the Anglo-American Exhibition of 1914, at the White City, was nothing to most of us but a shadow in the background of the future. The event is to celebrate the centenary of peace, and of progress in the arts, sciences, and industries, of the United States of America and the British Empire. During the time the gas industry has been busily occupied with other matters, the arrangements for this exhibition have been making headway, and our electrical friends have stolen a march on its principal rivals, believing that next year's exhibition is in itself going to be a popular one, and more so in view of the fact that the White City has been closed this year. The space on which the electrical industry has the option, or has actually booked (we do not exactly know which), is the choicest in the whole exhibition, being the right-hand side of the great central hall as one enters the Wood Lane entrance. We congratulate the electrical industry upon both its foresight and the position. This prospect of electrical representation, combined with the universal composition of the attendance which the White City attracts when there is really something good there, and with the fact that public gas supply in this country has now extended beyond the century which the exhibition is to celebrate, are all reasons why the gas industry should immediately take into consideration the question of not being absent from the White City next year. The position can be put stronger than this in the question, "Can the gas industry afford to be absent from the White "City next year?" Mr. Carpenter, after his investigation of the subject, emphatically says "No;" and, as will be seen from a letter in another column, he has, at a meeting of the Executive and Engineering Committee formed in connection with the projected celebration, inquired as to what space would be available in the event of the gas industry determining to make a display there. His letter and plan supply the answer. There is no time to be lost. The proposal comes somewhat early upon the heels of the National Gas Exhibition. But this is an event that was not foreseen; and the representation of the electrical industry makes it almost a compulsory matter for the gas industry to be in evidence in organized form. Supposing the gas industry determines to take space, we must not forget that this is an Anglo-American Exposition. Will our American friends be invited to take equal space with the British gas industry? It is understood from Mr. Carpenter's letter that both the British and American electrical industries will be represented in the Central Hall.

The Leeds Test, and Gas-Fire Efficiency.

WHEN the Gas-Heating Research Committee of the Institution of Gas Engineers and the Leeds University set out, some six years ago, upon the work for which they were appointed, the methods of testing gas fires had not assumed the scientific accuracy that was highly desirable in the cause of progress. But from the Leeds University there came to us equipment and methods that were accepted as meeting a long-felt need, and as constituting—at any rate, for the time being—a standard test. That was six years since. To-day there seems to be room for some agreed revision of the test and an extension of it, in order to obtain still greater practical accuracy and usefulness. There is now available, in our opinion, the experience that might, through conference, enable this to be accomplished. What was done at Leeds six years ago, and subsequently in the way of experimental investigation, there is no question, gave a fillip to the testing of gas-fires for heating efficiency and other matters, both in the works of the makers, and in the laboratories of the large buyers; and there are now several men, instead of a limited few, who can talk of gas-fire testing apparatus and methods with the authority that is born of experience and discovery of requirements.

Outside those who had some hand in devising the methods known as the Leeds test, there appears to be, among the men with experience of the instruments and methods comprising that test, almost perfect accord in alleging two things concerning them. The one is that the Leeds test demands great care in manipulation and conditions, and necessitates various small modifications, in order to obtain accuracy; and the other is that a simpler and more rapid test is required, which will enable quick investigation of efficiency to be made, with an approximate accuracy, in both makers' factories and in gas-works laboratories. What is essential is to settle first the alterations necessary, and the conditions under which tests should be made, so as to obtain the highest accuracy with the Leeds test. Having determined this, there would be the standard, from which what we have termed an extension could be made in the form of means by which rapid testings could be carried out which would give an approximate result to that standard, without expecting positive accuracy. We do not see why this cannot be done. The recent controversy in our pages has shown that there is fairly general agreement among gas-fire makers' technical staffs as to improvements being required in the Leeds test; it has also shown that in almost every makers' works different forms of radiometer and other equipment are in use for instituting rapid tests. This being so, we are naturally at times in something like a quandary as to the relative value of the tests which come before us. Even when we get appended to figures the words "Leeds test," we are not sure whether this means the use of the instruments and the application of methods as originally laid down, or those instruments and methods *plus* some improvement or correction that the tester thinks fit to apply. When works' radiometers and other instruments are used (which do not comprise the Leeds test), it is found that apparatus and conditions are so varied that we cannot, with any confidence, say what is the relation of the result of one test at one works to that of another test at some other works. We therefore think the time has come when we might be relieved of this uncertainty, and have testings—both standard and works'—placed on something like a universal footing.

This matter is brought to a head by the masterly lecture that Mr. Harold Hartley, M.Sc., the Chief Chemist of the Richmond Gas Stove and Meter Company, delivered before the Yorkshire Junior Association at the Leeds University on Saturday last. Some time since, Mr. W. J. Atkinson Butterfield and others, in our columns, intimated that they were not altogether satisfied with the Leeds test and the conditions of its use; and Mr. Butterfield, in an article published to-day, still hints at some doubt on his part, and promises to discuss the matter further when opportunity permits. Mr. Hartley presents his case for small modifying alterations in the Leeds test (more especially in these days of increasing size and efficiency of gas-fires), for care in use, and for standard conditions of use, so as to obtain with it comparable and reliable results. Mr. Hartley's

belief regarding the test is summed up in these words: "On the whole, I am inclined to the view that *with care* an "experimenter employing the Leeds method can obtain, "with a given gas-fire, results which do not differ by more "than 1 per cent., providing he employs a sufficiently sensi- "tive galvanometer, and that he takes due care to avoid the "introduction of any of the small errors which are liable to "crop up, but that the method is not by any means one "which can be employed by the man in the street." The points of improvement in relation to the instruments themselves can be gleaned from the full account of the lecture in this issue. Among the conditions under which the test should be made, Mr. Hartley holds that the chimney pull should be measured by means of a delicate pressure-gauge, and should be maintained as constant as possible by the aid of a suitable damper. Only by doing this are comparisons able to be instituted under similar conditions as to chimney ventilation; and some such control seems to be necessary if fair comparisons are to be made. And, again, we have Mr. Butterfield, coming fresh from further researches in connection with the recent controversy in our pages, saying that it is important that fires should be compared under, as nearly as possible, identical conditions in regard to room temperature, &c.—"a very important factor," he adds, "in "connection with the Leeds test." On the lecture and article in this week's issue, without going back to other contributions to the recent gas-fire controversy, we think that a case is made out for an agreed revision of the Leeds test, and for the settlement of a method to be generally applied for making rapid radiant heat determinations by the technical staffs of the makers and large buyers of gas fires.

The review by Mr. Hartley of gas-fire progress since the Gas-Heating Research Committee commenced their investigation shows what real advance has been effected, as particularly emphasized by the enhanced radiant heat efficiency of fires—viz., from about 40 to 60 per cent. With fires that will give the latter percentage of the available energy in radiant form, the lecturer, as he picturesquely puts it, is on more than nodding acquaintance—this high efficiency, we take it, being obtained by measurements made with the Leeds method improved in the manner favoured by him. Perhaps of more general importance than any other part of the lecture is the contribution that Mr. Hartley makes, from his investigations and experiences, to the question of the relations of hygienic efficiency to radiant efficiency. Though opposed to isolated high authority, it is not at all strange that again and again there comes the testimony of experience (we have it once more in Mr. Hartley's lecture) that there is no occasion for a gas-fire, when constructed in such a way that it will pass all its products of combustion through the flue-vent without the aid of a chimney draught, to lose any radiant efficiency when subjected to chimney draught. In fact, we have the lecturer giving his very pronounced view that the duty of makers is to consider the construction of fires that will pass the products through the opening provided for the purpose without depending upon such a variable factor as chimney draught. The fear that a condition of this kind will hamper progress, and restrict the radiant efficiency obtainable from a fire, has no place in the lecturer's mental view, because he knows, from his own researches, that nothing of the kind need happen—that canopies and hoods can be constructed of the necessary dimensions that will perform one service without producing the slightest deterioration in the other. This is not fresh intelligence. It is only confirmation of what others (Mr. Butterfield for the second time in this issue) have said; but conjoined to the confirmation is a description of still another means for effecting the desired end, and a means by which the canopy of the fire can be higher from the top of the fuel than would otherwise be permissible.

The controversy in our pages has done much good. It has proved that the attainment of a high standard of hygienic efficiency need not affect the radiant efficiency of a gas-fire; it has also proved that the majority of gas-fire makers were unprepared to accept, from whatever quarter it came, any stunted dictum to the contrary. The controversy has done its part in clearing the stage of misconception—misconception that, had it continued to stand unchallenged, might have acted as a barrier to progress. Work such as that of Mr. Hartley, confirming that of others, and opening up new considerations, makes it more and more difficult for contrary contentions to find acceptance, and does much to expose the misplaced tenacity of those who gave birth to, and who now defend, these contentions.

Prepared Tar for Road Purposes.

The day will probably come when we shall consider it as wasteful to supply crude tar for road purposes as we hold it barbarous to use raw coal in our house grates for warming rooms. The use of tar for the coating and the making of roads has worked wonders for the gas industry's tar trade; and really the gas industry, from the selfish point of view, has cause for gratitude to the mechanically propelled road vehicle for having raised (simultaneously with clouds of dust that produced human resentment) the commercial status of a formerly much depressed secondary product. A new application of this sort nearly always commences somewhat crudely; but time and experience come to aid in the evolution of a more perfect method of procedure. It is so in this instance; and we have therefore to acknowledge the importance to the gas industry of the paper presented by Mr. C. H. Webb, M.Sc., the Engineer of the Stourbridge Gas-Works, to the Midland Association last Thursday, on the subject of the preparation of tar for road purposes. The paper goes beyond the single question of dehydration; and we hope that the future consideration of the subject will not be reduced to that simple level. There is crude dehydration, and proper dehydration, just as there is crude tar and properly prepared tar. Several speakers in the discussion on the paper referred to the relative suitability, for road surfacing, of crude tar and prepared tar, as though the tar as sent direct from the gas-works was applied in the crude form without any preparation. This, of course, is a fallacy. The tar has to be heated in roadside boilers before application, and there we have a process of dehydration going on. But it is a very crude method; and, in a measure, Mr. Webb's paper commences to advance the proof that it is a wasteful one. Here then is the point that requires further investigation, as to whether the crude method of the roadside tar-boilers cannot be largely superseded by a more perfect method that can obtain at many gas-works, and be there rendered profitable. With a minimum sale of from 100 to 150 tons of prepared tar, Mr. Webb says it can be; and so gas managers are here confronted with not only an economic question, but one that should be considered from the point of view as to whether the keeping of the proper treatment of the tar within their own hands will not act as a preservative for them of this particular market.

We must all agree that the dehydration that takes place during tar heating on the roadside is a crude and uncertain process, without any adequate means of control attaching to it. The percentages of water, ammonia, and phenols vary in different tars from different coals, and even in the tar from the same coal where the process or temperature of carbonization differs. There cannot with the roadside boiler be efficient regulation to meet these variations; and therefore there cannot be, by such a crude process, any dependable production of tar consistency. With the Road Board specification before them, there will be a growing desire on the part of road surveyors to see that the tars they use comply with the specification, and more especially if the grants made by the Board for road improvements are subject to the stipulation that the tar employed must comply with the specification. There seems to us therefore every reason for seriously considering the question of the proper preparation on gas-works of tar to be used for road purposes. For the treatment of tars of various compositions, plant is wanted that can be heat-controlled according to requirement; and such a plant is found in the Wilton enclosed tar-dehydrating system. This is the plant Mr. Webb has adopted at Stourbridge, and which he describes in his paper. It is a plant capable of dealing with 100 gallons of tar an hour, which figure may be taken as the nominal, and not the maximum, capacity, because the quantity mentioned can be exceeded if the water content is not above a normal figure. The working of the plant is under absolute temperature control; so that, if the water content is high, or the ammonia and the phenols are above the specified limits, the working temperatures can be raised. If the tar is wanted for the purposes of a binder for macadam work, and not for spraying, an arrangement fed with superheated steam can be inserted in the tar under treatment, and the material of the stiffer consistency needed can be produced. We look upon this last point as a not unimportant one. The Road Board have come to the conclusion, and road authorities in some cases have also arrived at the same point of view and in others are rapidly drifting to it, that the conditions of our road traffic to-day demand the use of a more durable binder than

hitherto; and though the first cost may be greater, it is a first cost that will produce some compensation in reduced maintenance, and to an extent diminish the need for tar-spraying, although on roads that are so treated (which, we take it, would only form a minor percentage of those that demand in some way the application of tar) tar spraying or painting at regular intervals would be needed for the purpose of surface preservation. Road authorities appear to be more inclined than formerly to take up tar macadam work on their own account, rather than let it out on contract—for economic reasons, and in order to provide additional employment for local labour. Whether there will be the economy in this that is anticipated, we need not stop to inquire; but it points to the provision of facilities at the local gas-works for giving the local road authority two grades in consistency of tar—the one for road-spraying, and the other for road-making—as being a politic course with the view to keeping business at home. The facilities for doing this, according to Mr. Webb's experience, are combined in the one plant which he has adopted.

The financial aspects are important; and Mr. Webb appears to be perfectly happy in reference to them. He gives some general figures in the paper which most gas engineers will find sufficient for the formulation of a base for the consideration of the position in the light of their own local circumstances; but, in the discussion, he stated that he would be happy to answer privately other questions dealing with the matter of finance. We do not suppose that Mr. Webb desires to be inundated with inquiries; but we rather fear for a peaceful time issuing from his generous suggestion, seeing that there are several details bearing upon the matter that occur to one in considering it, upon which enlightenment would be very serviceable. However, he supplies the capital costs of the plant, he shows that little but space is required by it, that total repair expenses up to the present only represent (we calculate) 1·6d. per ton of tar treated, that the works coke breeze can be used for heating, and that 5s. cover the maximum expenses per ton of crude tar treated. But we see increased expenses, in some cases, for storage of the treated tar prior to the season's demands, and for the provision of proper transport vessels. On the other hand, the process gives light oils to a quantity equivalent to 10 per cent. of the dehydrated tar; and there is an amount of weak ammoniacal liquor that has a value. There is also under consideration at Stourbridge the question as to whether or not a plant now on the market shall be adopted for the treatment of the light oils, and the production of a 90 per cent. benzol. So from the sale of crude tar for road purposes, gas-works are invited to pursue a course that will help to systematize the tar business and place it for them on a higher plane. Financially, gas-works are doing better than formally from tar. Can they do better financially by adopting such a plant as Mr. Webb brings to notice? He intimates that they can, with a certain minimum trade at hand. Even if they cannot, it might be good policy, having an eye upon the future, to enter into the business. The paper is one of those that help to broaden the technical and commercial outlook from one of the many sides of the trading of the gas industry.

Outlying Village Supply and Tight Pipe-Joints.

The distribution developments of the gas industry have brought within the range of gas undertakings many small outlying villages; and these can now be economically connected-up with accruing mutual advantage. Even in those villages where there is in existence an independent supply, joining-up with the nearest town supply, and thus centralizing manufacture, the dealing with materials, and the management generally, can often be accomplished with monetary advantage to the villages and undertakings concerned. The last few years have witnessed much of this sort of distribution expansion; and it is a process of development that we are of opinion will now go along at a still more rapid pace. Prior to this movement, there had been, on economic grounds, a very great neglect of outlying villages, in providing them with one of the greatest services and conveniences of modern times. But town extension, high-pressure transmission, and other causes have brought in their train greater interest in the inhabited spots lying outside the denser communities. Further stimulation of interest in the matter has been produced by the action of Parliament in not agreeing to permit statutory gas concerns, with such unsupplied places in their prescribed areas, to treat them as private preserves over which they have rights that cannot be extinguished. Parliament has shown that it can not only confer, but can take away, territory, and transfer it to quarters that are prepared to undertake its immediate service.

This increased attention to outlying areas has produced fresh subject-matter for District Gas Association meetings. There have been various papers of late years describing how rural communities have been supplied by high-pressure transmission, and giving details of the work. The latest contribution is by Mr. W. M. Valon, of Stafford; and it was made at the Midland Association meeting last Thursday. Such papers, however, on special pieces of work, do not lend themselves to any very free discussion on the general policy of undertaking such business, as so much—in fact, everything—depends upon local circumstances producing justification or otherwise. The greater part of Mr. Valon's paper is taken up with an explanation of the needs of the three villages that he dealt with—Brocton, Penkridge, and Brewood—the manner in which the work was done, and the successful financial result from the point of view of the Stafford Corporation gas undertaking. It is an eminently practical paper, and has a distinct interest in that it so clearly presents, in substance, all that one desires to know. Mr. Valon, however, says the object of the communication is not a technical one, though the greater part of it is technical in character; and therefore, we take it, the object of it is mainly to direct attention to the general subject of supplying outlying districts, and the advantage attaching under distribution means nowadays at command. Nevertheless, the discussion turned on technical points, and generally on the subject of joints, which, of course, have a large importance, in that upon their soundness relies the ultimate part of the profitableness of business with a distant outlying district. The details of joints offer an extensive field for criticism and the relation of experience—some engineers like one form, some another; some do not like this shape or that detail, while others do. But as their likes and dislikes are generally based upon experiences in their own localities, and are frequently found to be contradictory of experiences elsewhere, the matter is a somewhat difficult one upon which to arrive at a final determination.

We get Mr. George Helps telling a dismal tale about his lead-jointed high-pressure mains (and which joints have now been discarded by him); while we have Mr. Valon, using lead-jointed low and high pressure mains and screw-jointed high-pressure mains, telling, in reply to the discussion, that he has got his leakage down to about 1½ per cent. over his whole district. But Mr. Helps, with welded joints on his high-pressure system, has still a leakage of about 8 per cent. in his area, or a reduction of 7 per cent. on the time when he had lead-jointed high-pressure mains. Vibration cannot be conducive to lead-joint stability; but the weakening of such joints would depend upon the manner in which the vibration is communicated. It is to vibration Mr. Helps attributes his earlier leakage experiences with the lead-joints of his high-pressure mains. But high-pressure lead-jointed mains in other areas where there is vibration appear to be standing quite well, notwithstanding Mr. Helps's very serious warning against their use. Perhaps at Nuneaton there was some other cause than vibration to account for the trouble—possibly something in the nature of subterranean movement. However, upon this point as to the stability of lead joints and leakage, the President (Mr. W. S. Morland) made some cautionary remarks which are worth special notice. He strongly advises, with adverse experience (not of his own making) before him, that pipes should never be used that are coated in the sockets or on the spigots or at any point of the joint connection. The joints should always be metal to metal. The experience to which he referred is a case in which a length of pipes laid to an asylum was coated inside and outside with Dr. Angus Smith's solution. Gas worked its way through the yarn and attacked the coating at the joint, with the result that a tarry liquid found its way to the syphon, and leakage of gas on the main was of a somewhat copious nature.

For his Penkridge main, Mr. Valon adopted screw-jointed pipes; and he speaks highly of them, although there again there are engineers who refuse to have them. But when he made the extension to Brewood, he returned to lead, using the patent long-sleeve joint. The reason of this change, in face of the excellent character he gave to the screwed joint, is that the cost would have been considerably increased in view of the screw-joint pipes having become

Association controlled subsequent to the laying of the Penkridge main. If control of the screw-joint means higher costs (which Mr. Valon found it did in his case), then engineers will either continue to use one of the old forms of joint or adopt something new. There is, for example, the strong advocacy by Mr. Helps of the welded joint, which he asserts is the cheapest of the three joints—lead, screwed, and welded. Mr. Helps appears to be a little enigmatical on this point; for figures that have come before us do not point to the actual cost of joint-making being lowest in the case of the welded form. But if he means that in the long run the welded joint is cheapest through the general stability, and the saving of labour and of leakage, then there may be something in what he says. However, he has experience of the various joints; and there are not a few who heard this statement and who will read it (Mr. Valon included) who would like to be favoured with more definite particulars on the point.

The paper was a good one, and it drew an interesting discussion, which showed that high-pressure transmission is becoming more and more an indispensable part of a gas-works system, that it assists in extending the area of the gas business, and that, in bringing it into service in this direction, we have now reached much more definite lines of procedure and knowledge, together with more serviceable auxiliaries than existed but a few short years since.

Gas Consumption at the National Exhibition.

For demonstration purposes, during the run of the National Gas Exhibition at Shepherd's Bush, there were consumed 6,264,000 cubic feet of gas, out of a total quantity of 6,607,070 cubic feet supplied from first to last. As Mr. R. J. Neville-Neville, M.P., the Chairman of the Brentford Company, stated at the luncheon given by the Metropolitan Gas Companies to members of the British Commercial Gas Association, his Company had the privilege of supplying the gas to the exhibition. The Company's revenue may visibly swell by this large consumption. But knowing what we do as to the nature of their subscriptions to the exhibition funds, it is clear that there is no real profit for them in the additional revenue. Besides which, of the expenses incurred in the mainlaying and other work undertaken by the Company in connection with the exhibition, probably not more than one-half will be charged up. There is no question that the Company have borne a very fair share of the outlay on the big demonstration. Indeed, Mr. Neville and his colleagues have displayed great enterprise in the matter; and, at the back of the Board, we see the Engineer and Manager (Mr. Alex. A. Johnston), in whom the Directors have such pronounced faith.

Co-Partnership.

Co-partnership had a strong innings at Leeds last week-end. The gas industry takes the lead in this matter; and the two chief advocates in the industry of this means of producing industrial and social reform were there to further the principles they have so much at heart. The University Society for Social Study had the subject before them on Friday in a paper by Mr. Charles Carpenter, D.Sc.; and he treated the question of co-partnership in its relation to industrial efficiency. As the whole work of the University is devoted to the promotion of industrial efficiency by scientific aid, the discussion of the means for promoting efficiency by other means was quite appropriate. Then on Saturday at the meeting of the Labour Co-Partnership Association, in the same city, Sir Corbet Woodall, D.Sc., took a still broader view of the subject when he expatiated upon co-partnership in relation to the public good. The papers are published in this issue; and we hope to have an opportunity in our next issue of commenting on them.

A Gas-Works Purchase Arbitration.

Like discussions into which the "hypothetical tenant" enters, gas and water works purchase arbitrations always present points on which a diversity of opinions may be expressed; and the proceedings last week to determine the price to be paid by the Ashborne Urban District Council for the undertaking of the Ashborne and District Gas Company proved no exception to the rule. The hearing extended over three days; and, in fact, it was only concluded on the third day by the tribunal sitting till close upon six o'clock. Mr. Ernest Moon, K.C., made an excellent Umpire; and Sir Corbet Woodall and Mr. Harry Jones occupied positions in which they have had much experience, as Arbitrators respectively for the Company and the Council. From the report of the Company's case which is given elsewhere in this issue, it will be seen that the value placed upon the undertaking by Mr. E. H. Stevenson and Mr. Henry Woodall was £59,823 and £58,731, based on 25 years' purchase. On the other hand, Mr. J. F. Bell, for the Council, thought £26,926 (based on 20 years' purchase) would be a fair price for the concern. Mr. Edward Allen gave evidence very much in agreement with this, as did also Mr. Frank Jones. Much of the evidence turned upon the vexed question as to the proper allowance to be made for repairs and maintenance of works, mains, meters, &c., and also on what should be regarded as suitable provision for storage in relation to the maximum day's make. Other matters entering into the discussion were the margin of retort capacity necessary for safe working, and several definite contracts entered into which were calculated to largely influence the amount of gas sent out after the close of the account year. The Ashborne Gas Company is one which has grown from very small beginnings—much of this growth having been provided for by the profits made; and the evidence given was to the effect that the shares have been greatly esteemed locally as an investment. A report of the case for the Council and the speeches which followed will be given in our next issue.

The Vitality of the Industry.

There is not an undertaking in existence that furnishes such lessons for the gas industry as the Imperial Continental Gas Association. Its structure is composed of gas businesses in cities and towns on the Continent. It has become quite accustomed to having whole limbs amputated in the form of cities and towns as the concessions lapse. Yet, with the severance, progress continues. The business of the Association shoots out in fresh places from the cities and towns already in its possession; and it finds fresh fields for the employment of capital. There is no going back. As an illustration, a sentence from the speech of the Chairman (Sir Charles Jessel, Bart.), at last Tuesday's meeting of the proprietors, will suffice. "You will be pleased to hear," he said, "with respect to the sale of gas, that we have made up in a twelvemonth for the loss of Aix-la-Chapelle." This is the result not only of putting out fresh distributing arms from the existing centres of supply, but of developing business within the old areas notwithstanding all the competition of the electric light. Just, think of it—the whole loss of the gas business of a city made up by the existing stations in a single year. Those among us who view with alarm the increased financial obligations placed upon industrial undertakings in this country should read what Sir Charles said as to the piling-up of taxation in Germany. We are all in this regard in similar boats; but there seems to be a bit more ballast in the German one.

The Somerset and Gloucester Promotion.

The end of the tale concerning this promotion is to hand; the first part having been told in our issue for Oct. 28 [p. 283], when we criticized the scheme, which, in our opinion, was not financially good judging from the estimates presented in the prospectus. There were other aspects of it, too, which did not meet with our approval. But the real rock on which the project split was the action of the Bristol Gas Company, who had statutory rights over the best part of the area in which the promoters had laid the scene of their prospective operations. Litigation did not appeal to the promoters; so they took the only sensible course open to them. They have returned the money subscribed; but the restitution of the money was preceded by a circular to which further allusion will be made presently. The fact that the Bristol Gas Company had powers of supply over the area in question must either have been within the knowledge of the promoters or it was not. If not, then the promoters had been very badly advised; and we strongly urge investors not to have anything more to do with schemes issuing from the same quarter unless they are satisfied—first, as to the area being wholly territory over which an existing concern has no rights; and, secondly, that the scheme has been thoroughly investigated and approved by a gas engineer of recognized standing in the industry.

A New Scheme Under Way.

In the circular which preceded the return of the money subscribed for the Somerset and Gloucester project, it is stated that

the "Directors much regret that you [the subscriber] should have been deprived of the opportunity of this investment, owing to the above-mentioned difficulty." Instead of joining in this regret, we heartily congratulate the subscribers, because we feel, from the examination we made of the scheme, that their regret would have been in the future more poignant than any that the Directors feel over the deprivation of the "investment" opportunity held out by the defunct promotion. The promoting United Gas-Works Development Company, Limited, however, have no intention of letting the grass grow under their feet. In the circular referred to, they state that they are interested in another "sound proposition" which will shortly be issued to the public; and they have agreed to give the subscribers to the Somerset project "the first opportunity of participating upon most exceptional terms." In the letters covering the return of the cheque, it is also intimated that an unappropriated district has been secured, and that the subscribers to the Somerset Company who make application will receive preferential allotment when the issue is made. Until the fresh scheme has been properly investigated, we advise all subscribers and others to refrain from parting with their money. The promoters would no doubt be glad enough to give those who have regained possession of their subscriptions a preferential allotment, as well as exceptional terms. We are not enamoured of gas prospectuses issued with exceptional terms attached. We have had so much of the heavy bait order of prospectus in connection with the disastrous flotations of certain promoters, that there is an inclination on our part to regard all gas prospectuses with suspicion which hold out special temptations to the public. Good gas schemes do not require to be propped up in this way to obtain money for them.

The United Gas-Works Development Company.

Who and what is this Company? Who are the people who have united themselves for the beneficent purpose of developing gas concerns? Until the Somerset scheme came before us, we had never heard of this Development Company. As a matter of fact, not only had the Somerset and Gloucester Company no statutory rights in the district it was proposing to exploit, but it seems that, when the prospectus was issued, the United Gas-Works Development Company had not even been registered, and does not appear to have had any very tangible existence. It was only on Oct. 29 that the Company was registered, and with the magnificent capital of £2000! As a paragraph elsewhere in this issue states, the record at Somerset House shows that there are seven signatories taking one share each. and it is provided that the Directors may proceed to allotment on a subscription of seven shares. If they do, the promoting Company will not have very much backbone for their gas-works "development" mission. Enough said on this point. But we must add that the more we look into promoting work of this particular kind, the less we like it. There has been so much of the professional promoter mixed up with small gas schemes, and so much wreckage as a consequence, that we are not disposed to look favourably upon any schemes emanating from any outside promoting quarters until we have had full opportunity of making very close investigation of the proposals. We do not personally know the people connected with the United Gas-Works Development Company. Their actions may be perfectly honest, within the limits of their own knowledge of gas enterprise; but, unless their proposals are guided or supervised by a man whom we regard as having a good standing as a technical expert in the industry, we shall subject the schemes to the closest scrutiny before recommending them.

Smokeless Fuel.

The London Coke Committee, whose work was noticed editorially on Oct. 21, have issued a leaflet for enclosure with letters and accounts. On the front page of the leaflet are the words, with pictorial surrounding, "The Smoke Problem." The only criticism we have to make is that we should have liked to have seen the leaflet printed on better paper; the information is worth it. It is all comprised in a very few lines, and is therefore very much to the point. The first half-a-dozen lines tell how smoke from coal fouls the kitchen chimney and the air. The second half-a-dozen lines submit a problem. The housewife cannot make full use of the gas-cooker, because of the necessity to light the kitchen fire for the purposes of hot water supply for baths, &c. How is she to get over the difficulty? The third half-a-dozen lines give the solution. Where a gas-heated water-circulator is not practicable, then the coke-boiler comes in; and it can be attached to the present water circulating pipes. The result is the economical production of an abundance of hot water for baths and household purposes, without smoke. Besides this, the boiler will burn the house refuse, and will keep the kitchen warm in the winter. The managements of gas undertakings will be doing themselves a real good turn by trying to develop the use of the coke-heated water-boiler, in addition to the attention they are bestowing on the advancement of civilization by developing the use of the gas-heated water-circulator. It does not require a long discourse to show the reason why.

The Radical Change.

The development and changes which the gas industry have undergone have been so gradual and, being gradual, they have been accepted as quite natural, that we have not looked upon the metamorphosis as being of a radical nature. But it is so; and the industry has passed the critical period, and is now completely on a new high road. Still some administrations are living in the past; while their undertakings are struggling in the old-fashioned administrative harness trying to live up to, and to be of, the times. In his Presidential Address to the American Gas Institute, Mr. Walter R. Addicks had a tilt at the survival of primitive laws in the governing of modern repuirement. This is all a drag on progress. Industrial conservatism clings to the old law that ordains a high illuminating power gas that is absolutely useless, and provides the very elements which act destructively on the maintenance of the highest efficiency of the bunsen burners that render the best of service to the gas consumer to-day. In protecting the ancient quality of gas, those responsible are forcing upon gas undertakings and communities an uneconomy which is entirely inconsistent with the progressiveness of present times. What is wanted, says Mr. Addicks, is a reasonable calorific standard of working; and may we add a calorific standard that will enable the largest amount of heat units to be extracted in the form of gas from every ton of coal. In so working, there is economy and advantage for undertakings and gas consumers.

The French Railway Disaster.

It may be anticipated that there will be more screechings from the electrical press on the subject of the use of gas on railway trains, following the sad disaster near the little station of Melun on the Paris, Lyons, and Mediterranean Railway. There have been the same lay newspaper reports, charging gas with having contributed to the fire on the train; but the ordinary newspaper reporters cannot be expected to examine matters with technical knowledge to assist them. Their assumptions are gladly accepted by such papers as the "Electrical Review" and "Electrical Times" as representing actual facts. The reporters told that, on this occasion, the crash was followed by explosions of steam and of gas. They were not present at the time; and it passes comprehension as to how anyone would be able under such conditions to faithfully discriminate between explosions of steam and of gas. When the gas reservoirs are examined, they will show whether any damage they suffered was caused by an external application of force or by an internal one; the direction of the edges of the rent or perforation of the metal being evidence of this. The reporters state that the wreckage caught fire in a few seconds. This is not at all surprising, seeing that the engine of the Marseilles express was turned completely over, and was lying on one of the postal train cars, which had been absolutely smashed. It was only after this that the gas-tanks were supposed to have exploded, which is a contradiction of the earlier statement that the gas-tanks exploded after the crash. Let us ask our electrical friends what would make the gas-tanks explode? There could be no access of gas-pressure to cause the tanks to burst, except the application to them of tremendous heat, with no vent for the gas, which heat could only be produced by a fire already raging. If they exploded, it would show the gas under high-pressure had not escaped, and the pressure had not been relieved; and when they did explode, the gas would not stay in the vicinity to be burned up. The electrical papers, or some of them, go into hysterics over the ordinary newspaper man who attributes a fire to a short-circuit; and they give no reason for

doing so. They accept as gospel all that the same ordinary newspaper man says about the use of gas on trains; and still they give no reason for doing so. Have they no technical knowledge whatever by which they can for themselves examine the whole question?

Debenture Wrinkles.

Though the very word "debenture" carries with it a sense of security, it was made evident in the course of a lecture which Mr. H. W. Jordan delivered under the auspices of the Secretaries' Association that the investment of money in debentures is a process requiring just as careful consideration as other financial transactions. There are debentures of various kinds—and qualities. In fact, as he clearly showed, it is a method of borrowing which lends itself both to use and abuse. Some of the "freak" debentures quoted by the lecturer were distinctly amusing; but they had their serious side, as indicating the elasticity allowed to companies and the inadequate nature of existing safeguards, owing to which "the unscrupulous have many opportunities for defrauding others, and the wise and prudent are fleeced almost as much as the ignorant and foolish." The lecture was a good one all through, but especially so at the end, where a series of wrinkles were given. The advice chiefly came under the head of "proper inquiry." A company must be empowered by its memorandum to borrow, or the power must be implied. The sum raised must not exceed the amount authorized by the articles. When uncalled capital is charged, the power taken must be wide enough to include it (as is the case if the word "assets" is used). These and other particulars can be gathered from an inspection of the file of the company. But another practical bit of advice may be noted. It is that if a person already holds debentures, and the company are unable to pay the entire amount of interest due, the holder should not allow his claim to be postponed in favour of those of others who may be more pressing. It was pointed out that it has quite recently been held that, in the event of foreclosure, the Receiver must not pay the arrears of interest to those who have exercised consideration towards the company, and thus put them on the same footing as the others; for they are only entitled to be treated as secured creditors on the funds of the company for the amount of the principal and interest, and to payment *pro rata*.

Combined Private and Municipal Ownership.

In the first instance, public utility supplies in Germany were, as is usually the case, provided by private enterprise; and to this period there succeeded, as also experienced elsewhere, a time when municipal trading found favour. Now, however, it appears, from an official report of the Commercial Attaché in Berlin, the tendency is all in favour of a combined system, under which the works are managed by a private company, in the working of which the interest of the community as such is safeguarded by a participation in the capital and in the management. It has been discovered that purely public enterprises have been too thoroughly tied to move as rapidly as modern circumstances of trade and industry may require. A less convincing argument is to the effect that the best managers cannot be secured among municipal officials with only municipal pay. This is surely an argument (if it has any reason at all), not against municipal ownership of undertakings, but against municipal rates of pay. The next point is that the councils, as controlling bodies, show lack of technical understanding. In this case, there is all the greater need to secure the best qualified advice, regardless of the limits of "municipal pay." We all know, casting our thoughts around, how many earnest students of gas affairs are to be found on gas committees in this country; but in spite of this, it may fairly be admitted that the ordinary councillor is not elected to his position because of expert knowledge in any particular direction. Next, that expected profits have not materialized, because the rate of charges had to be lowered in deference to the demands of the people's representatives, or because wages had to be unduly increased. This is the old, old question. Why should profits be expected? Would not a fairer test of municipal trading generally be its ability to provide a cheaper and better service than private enterprise is capable of doing? The report referred to alludes specially to electrical undertakings; but its main points seem to be equally applicable to practically speaking all other branches of municipal activity.

OBITUARY.

The Directors of the Aldershot Gas, Water, and District Lighting Company have just lost by death one of their colleagues—Mr. Richard Bateman, J.P.—who unfortunately succumbed to an accident in the hunting field.

The death occurred last Thursday, at his residence at Carnarvon, in his eightieth year, of Sir William Preece, F.R.S., the distinguished electrical engineer and the pioneer of wireless telegraphy. In the early days of electric lighting, he took a prominent part in connection with the new industry, and was always a staunch supporter of it. Sir William was a Past-President of the Institution of Civil Engineers, President of the Society of Telegraph Engineers (now the Institution of Electrical Engineers), and Chairman of the Council of the Royal Society of Arts in 1901-2. He held successively the positions of Divisional Engineer, Electrician, Engineer-in-Chief and Electrician, and Consulting Engineer to the Post Office, and retired in 1904. He was made a C.B. in 1894, and a K.C.B. in 1899. During the past few years, except for periods of illness, he had been active in the interests of the electrical industry; but he had been unwell for some time before his death.

RETIREMENT OF MR. EDWIN ROE, OF NOTTINGHAM.

Fifty-one years' continuous association with responsible official work is not an experience which falls to the lot of the average professional man; but this is the conspicuous record of Mr. Edwin Roe, the Chief Clerk to the Nottingham Gas Committee, upon the engineering side of the undertaking. He has just relinquished active connection with this important department of Corporation enterprise.

News of Mr. Roe's retirement will be received with regret, for necessarily during his long tenure of office he was brought into very close acquaintance with many of the leading representatives of the gas industry in the country, by whom his unvarying courtesy has been as well known and highly appreciated as by those among whom he lived. His period of service has been coincident with that of Nottingham's greatest expansion in municipal affairs, in which a notable feature has been the development of Corporation trading concerns, of which the chief is represented by the gas undertaking.

Mr. Roe became associated with the work some time before the gas supply became vested in the Corporaion. In the year 1862 he entered, as a youth, the service of the Gas Company, whose statutory rights were acquired twelve years later by the Corporation. At the period referred to, Nottingham lay for municipal administrative purposes within a small area surrounding the Market Place; but the Gas Company possessed rights of supply to Beeston, Carlton, Arnold, and other outside places, then comparatively small villages which have since grown into important townships. With the extension of the borough boundaries in 1877 came an era of marked development in Nottingham affairs, and *pari passu* with large improvement schemes typical of municipal enterprise far-reaching extensions of gas resources were witnessed. Originally, carbonizing stations of moderate dimensions at Eastcroft, Radford, and Basford represented the whole available sources of supply. The Eastcroft depôt, the oldest in point of establishment, and now to a large extent remodelled, still serves an indispensable purpose in the central part of the city; at Basford the largest expenditure in the history of the undertaking was incurred many years ago by the Corporation, to make it the main centre of supply; and within the last few weeks the Radford works have been brought up to date by the installation of the Glover-West system of vertical retorts. Another striking evidence of the great growth which has been witnessed during Mr. Roe's official career is that, whereas in 1862 the quantity of coal carbonized was 36,000 tons, last year it had risen to 196,095 tons; the gas made having increased in the same period more than six-fold—the amount being represented in the last annual period by 2,210,000,000 cubic feet. Illustrative of the extent of the undertaking, it may also be noted that, with its numerous extra-municipal centres of supply, Nottingham has nearly 400 miles of mains—one of the largest mileages in the country.

Mr. Roe, who from a minor position at the Radford works, rose to be chief of the clerical staff at the head office in George Street, has served under no fewer than six Engineers, of whom the first was Mr. Thomas Hawksley, who was in the nature of a consulting head. Mr. Hawksley was succeeded in the control by Mr. M. O. Tarbotton, who was also the Borough Engineer; Mr. Lewis T. Wright, previously associated with the Gaslight and Coke Company, who held office from 1883 to 1888; Mr. W. R. Chester, who was Engineer for fifteen years up to the time of his death in 1903. Mr. J. H. Brown, who was in control for nine years; and Mr. John Wilkinson, the present Engineer and Manager, formerly of Halifax, under whom record figures in relation to the undertaking were established last year. To many of the older members of the profession it may not be without interest also to recall that at the time Mr. Roe first entered upon official work in Nottingham the Managers of the branch stations were Mr. S. Tagg at Radford, Mr. Thomas

Whittaker at Basford, and Mr. Charles Taylor at the Eastcroft works—the latter afterwards going to Derby.

In his retirement, Mr. Roe (who is residing at "Lyndhurst," Douglas Road, Nottingham) carries with him the good wishes of hosts of friends, including especially those belonging to the Masonic craft, among whom, as a member of the Southwell Lodge (one of the oldest in the Nottinghamshire Province), he is, as by others, held in the highest regard.

ELECTRICITY SUPPLY MEMORANDA.

Sir William Preece.

We can pause for a space from criticism, controversy, and the presenting of intelligence, to add, at the close of an imposing chapter in life, our share of admiration and respect for a man who did so much for the advancement of electrical science, and whose life has been largely spent in its service. The days of Sir William Preece have been many; and they have been purposeful and successful. As we glance back, we see in his life much of the history of electrical development; and through his great mental acuity and ability, combined with influential position, we also see how much he individually did in advancing the interests of the industry to which he was devotedly attached. He was indeed one of its living spirits; and one who did much in assisting its service to materialize in practical ways. Though in relation to some of the matters of controversy between two industries at points where there exists commercial rivalry, we had occasionally a little fling at the use by Sir William of stock commonplaces, which so ill-fitted him, we rarely found him other than broad-minded and frank, and not indisposed to examine things from the point of view of those who did not see eye to eye with him. It was not long since that he occupied the chair of the British Coalite Company—a Company which he firmly believed was destined to be a pioneer in a revolution in coal carbonization, and in the production of improved resultants of destructive distillation (of which gas is one) such as, he believed, the world requires. He stood by the Company when some others fled from it; and we often felt that he might have been saved from any participation in the failure had he had a more intimate knowledge of the technical and commercial work of the gas industry. But he has gone, with full honours, from the world in which he worked, and which is the better for his life and his labour in it.

A Point-Five Failure.

The Point-Five tariff does not attract everywhere, even when supplemented by verbally attested miraculous savings in joints of meat. Man, woman, or child cannot, or rather does not, live by meat alone, so there are other things to be cooked. When one comes to talk of these other things, and of the hypothetical weight savings of meat cooked in an electric-oven, in comparison with the rational methods of baking in a gas-oven, and boiling on the top plate, the householder nowadays becomes merry—sometimes very merry. The last meeting of the Point-Fives Association was presided over by Mr. C. S. Davidson, of Barnes. The people of Barnes, it seems, have not been infatuated by the 0·5d. decoy; and so Mr. Davidson has to acknowledge that he cannot record any very striking increase in business activity due to the introduction of the 0·5d. tariff. No charge of lack of enterprise can be made against the Barnes Electricity Department. Enterprise is up to high-water mark. But enterprise, *plus* the 0·5d. tariff *plus* the shrinkage savings, has not been successful in enticing the people. Only 100 consumers have elected to be charged on the rateable value basis; and though information is sought regarding appliances other than for lighting, the inquiry seems to be as far as the consumers go with the matter. This does not say much for the information they gain. In Mr. Davidson's opinion, the secret of the apathy and disinclination of householders to go in to a greater extent for domestic electrification is that his undertaking has not a sales and hire department. But what does that matter when the consumer can be told, if not assured, that, by adopting electric cooking, there will be a saving of—let us see, we think (according to the elasticity of the electrical conscience) it ranges from 20 to about 60 per cent. on the butchers' bill. Under such circumstances, a hiring department would be superfluous; for the saving on the butchers' bill, if real, would compensate the householder magnificently for changing over to electrical operation. Enterprise, the 0·5d. tariff, and saving in the loss of meat! Still the householder will not bite. There must be a fine amount of wisdom resident in Barnes. By the way, in his address to the Newcastle Section of the Institution of Electrical Engineers, Mr. C. Vernier points out that of 287 undertakings whose generating costs are analyzed in the "Electrical Times," only five, or less than 2 per cent., show a works cost of 0·5d., or under, per unit.

The Middle-Day and the Late Diner.

Week by week, the men of the gas industry find good cause for gratitude in that their lot is not that of their electrical competitors; for the latter have to keep their eyes on all sorts of conditions that do not worry their gas rivals. Fancy a gas man having to trouble himself as to whether any particular load comes in the middle part of the day, the evening, or during intervening hours. But it is the condition of the electrical engineer. He is trying to develop a cooking load on low-priced units; but in the "Electrical Review" a recent writer on the subject of electric cooking points out, as though it were quite a new thought (attention has frequently been directed to it in the "Memoranda") that the users of these cheap units, if any considerable number of them are late diners, will cause an uncomfortable access to the winter's lighting peak—that is to say, if their custom is obtained for this purpose—with the further result of additional generating plant being required to supply the low-priced units. The fact that this has not been a result up to the present shows that the custom for cooking is of a very attenuated order, as the late diners are about the only people on the face of the earth who could afford, if they so desired, to entrust their meal preparation to time-absorbing and unreliable electrical operation. This being so, sound electrical policy demands that the late diner should be denied the doubtful luxury of electrical operation, unless he pays a cost per unit that will cover all the expenses, capital and otherwise, incurred in his behalf. This leaves the electrical concern with the middle-day diner; and, through the time of his chief meal being when it is, he would be, from the generating station point of view, the more preferable consumer if (that mighty "if" again) he could afford to pay, even the "low" prices charged for the service—"low" prices that still mean high bills for the work done. The writer in the "Electrical Review" thinks that the middle-day cooking would be done when the industrial motor load was off—that is to say, during the time that the men looking after the motors and other industrial operations were engaged in eating their dinners. As the dinners have to be cooked before they can be eaten, the cooking would be proceeding while the industrial motors were at work. A *cul de sac* is found at every turning in the electrical cooking line. But there is something else. The writer in our contemporary agrees that the working man, with his limited income, is not going to take to electrical cooking unless he sees an actual reduction in his "fuel" bill; and the writer in question, being a philosophic man, fails to see how lower bills can result from electrical operation in comparison with gas at 2s. 6d. per 1000 cubic feet. There is also the cost of the appliances; and this cost the working man cannot entertain. There is likewise the maintenance; and heaven help the electrical undertaking that enters on the cooking business in working-class houses unless it can produce something that has all the resisting power of the gas-oven. On the whole, things do not look very rosy for this cooking business by electricity. Commenting on the article referred to here, Simplex Conduits, Limited, call attention to an electrical apparatus of their production, which they say will cook a 6-lb. joint of meat on 1 unit of electricity. Always the same with these electrical men! Does cooking begin and end with the baking of meat? Is a gas-cooker used for no other purpose than baking in the house of the working man?

The Modern Faraday.

Mr. H. Faraday Proctor is the Electrical Engineer to the Bristol Corporation. He is not only this, but he is an optimist; and we rather think he is depending upon something happening that, had he been *au courant* with electrical literature, he would have known has a bad foundation. In his capacity of Chairman of the Western Local Section of the Institution of Electrical Engineers, he has been speaking of the coming of the ½-watt tungsten lamp for domestic purposes, and talks glibly of compensation being derived from consumers going in for more generous lighting, and greater artistic effects. But the ½-watt domestic lamp appears to be as far off as ever. Investigation has shown that the loss by convection is more serious with small metallic filament wires than with those of larger diameter. It is therefore better to use, if practicable, filaments of large diameter. But lamps with the larger diameter filaments in them must be made for heavy currents. Thus the large unit ½-watt-hour-per-candle lamps that are promised. Small lamps could not be made that would give a candle efficiency per ½-watt. There is another point that Mr. Proctor has quite overlooked; and that is as to the intrinsic brilliancy of the filaments of lamps having an efficiency equal to 2 candles per watt-hour. The intrinsic brilliancy is no less than five to eight times as great as that of the one-watt-per-candle filament lamp—if there is such a thing in existence. Tests usually give a result of about 1·3 watt-hour per candle. The "Electrical Review," speaking of this great increase in intrinsic brilliancy, says: "No doubt this will be a useful property in some applications, but not in the lighting of streets or interiors, for which the unshielded glare of the filament is already in excess; and therefore it will be necessary to sacrifice some of the gain by using diffusing screens." Mr. Proctor's hopes do not seem as though they are going to be fulfilled in all respects. Another point is that, if such a domestic lamp did come along, it would raise the proportion of small consumers; and already, under present circumstances, Mr. Proctor does not seem to be particularly comfortable over the relation of capital costs to the revenue derived from the small consumer. If the ½-watt lamps came, they would make the consumptions of small householders of a still more limited order. Then whence would come the profit to meet the expense involved by the small consumer. In Bristol, the present cost of connecting premises adjoining the electricity mains is £3 8s. (exclusive of the cost of the meter); and the average revenue per connection derived from 20 per cent. of the lighting

consumers amounts to only £1 15s. per annum. This is not particularly good business.

Water Heating Proposals.

Mr. Proctor also gives his views as to the lines on which he considers an economical electric water-heater should be designed. The word "economical" has no legitimate place in this connection, with the standard of time and cost performance taken from water-heating by other fuels. However, our friend's views may be reproduced for what they are worth. He says:

To get rapid and highly efficient water-heating, it will, I consider, be necessary to use immersion heaters, probably applying the heating element direct to the water, avoiding the risk or possibility of shock by utilizing the resistance of two columns of water—one on the supply side and the other on the delivery side of the heating appliance; the supply and delivery extremities of these columns of water most remote from the heating elements being electrically short-circuited and earthed. The elements must, in such an appliance, be either self-cleaning or be arranged so that they may be very readily cleaned, so as to avoid trouble due to lime or other deposits. I look to such appliances arranged alternatively, for rapid water heating supplied at the usual heating rate of charge, and for continuous use supplied on a fixed annual kilowatt charge, as the probable solution of the domestic hot water problem.

Mr. Proctor will look in vain. With great confidence, we regard gas or coke as the best solution of the water-heating problem; and gas and coke have made, are making, and will continue to make, excellent progress in this connection. We will, when there is more leisure, ponder over Mr. Proctor's notions for an electric water-heater; for they want some amount of working out by anyone accustomed to the simplicity of the gas-heated water-boiler. The "Electrical Times" does not appear to be enamoured of Mr. Proctor's suggestion. It rather sees the leakage of current from the live terminal of the heating element to the nearest part of the frame. There has lately been a great deal of talk about the trouble of framing ironwork of electrical appliances becoming alive, and as to the necessity for the earthing of every part. This talk has had its origin in the kitchen, and has been of an expressive nature, though not of the technical quality of that which has taken place outside the kitchen. However, our contemporary does not think the loss to which it refers would be serious. But it sees a greater objection to the use of elements directly immersed in water, and that is the effect upon the supply network. "The risk of earthing the network on a three-wire distribution with neutral earthed at sub-stations is a real danger with such a system, particularly on direct-current supplies; and the general adoption of such heaters, taking heavy loads for short periods, would, we imagine, be viewed with alarm by station engineers generally." Commenting on the question of cleaning the elements, our contemporary rightly says that great caution would be required in carrying out this work; and few makers would care for anyone not familiar with their heaters to attempt the task. On the other hand, enclosed elements could readily be freed from deposit by any intelligent man without risk of damage.

Prodigious!

Talking of water-heaters, we are sure the leisured class will be interested in hearing of the "Losles" electric water-heater, which is an automatic arrangement introduced by Mr. C. Wilkinson, of Harrogate. A small current for a long period is the fundamental idea of the heater; and a thermostat (which we venture to think will not often be required) is provided for the cutting-off of the current when the desired maximum temperature has been reached, and so avoiding losses due to the boiling away of the water. Such a contingency is not expected to be of frequent occurrence. These heaters, we learn, have been made up to 40 gallons capacity; but the standard size is for 12 gallons, and is 36 inches in height and 12 inches diameter. There are two heating elements, each controlled by the thermostat, and each taking 500 watts. The thermostat acts on quick make-and-break switches of asserted reliable construction. It can be set to cut off as high as 200° Fahr., but is usually arranged to furnish water at from 160° to 180° Fahr. With one heating element in action, about 24 gallons of hot water can be obtained per twenty-four hours; and when the second heater is switched-in, the rate of heating and output of hot water is doubled. This remarkable rate of obtaining hot water is one of the charming features of the invention! But seriously is it not time that electrical men left off playing with this water-heating problem, and devoted themselves to something of greater usefulness in promoting the economy and service of the world?

The "Thomas Hawksley Memorial Lecture" will be delivered at the Institution of Mechanical Engineers on Friday, the 5th prox., by Mr. Edward B. Ellington, a Past-President, who will take for his subject "Water as a Mechanical Agent."

While deeply regretting the cause of the change, all who know him will be glad to learn that Mr. Charles F. Botley was unanimously appointed last Thursday by the Directors of the Hastings and St. Leonards Gas Company to the position of Engineer and General Manager in place of his father, the late Mr. C. E. Botley.

A COMPARISON OF METHODS OF TESTING THE RADIATION OF GAS-FIRES.

By W. J. A. Butterfield, M.A., F.I.C., Assoc.Inst.C.E.

In an article on "The Relation of Flue Ventilation to Heating Efficiency in Gas-Fires," which was published in the "Journal" for July 22, page 232, the writer gave the results of a number of testings of gas-fires in which the radiation had been measured by means of a water-flow radiometer devised by Mr. W. R. Twigg, the Technical Manager of the Davis Gas-Stove Company. Reasons were given in the article why this type of radiometer had been preferred for the particular series of investigations which were described. It was pointed out that, for comparative tests of two fires of similar construction, there seemed to be no objection to the use of this type of radiometer. But the writer stated that he hoped later to give a comparison between measurements of radiation of gas-fires by this type of radiometer and one of the thermopile type.

Such a comparison has now been made on the two fires which were used in the observations recorded in the former article. These two fires—viz., a Davis's No. 1 "Apollo," and a Wright's 10-inch "Mascot"—were the identical ones employed in the former tests. The thermopile radiometer now used for the comparative tests of the two fires was one of the type devised by Professor W. A. Bone and Dr. J. Drugman, as adopted by the Gas-Heating Research Committee of the Institution of Gas Engineers. The method of measuring radiation by this apparatus is generally and conveniently known as the "Leeds" test, since it was invented and first used in the Fuel-Testing Laboratory attached to the University of Leeds.

In these comparisons, which extended over a number of days, the fires were set up in turn in front of the "Leeds" thermopile radiometer; and the rate of consumption was made as nearly as possible the same as in the former tests with the Twigg radiometer. Ample time was allowed for the fires to attain their full radiating efficiency, and the measurements of radiation were then made. Half-hourly observations of the calorific power of the gas (which, fortunately, varied very little throughout each set of comparative tests) were also made. The two fires were compared in as nearly as possible identical conditions in regard to room temperature, &c.—a very important factor in connection with the "Leeds" test.

The former series of tests showed that the Davis's "Apollo" fire, without elbow or flue-pipe attached, gave a radiation, measured by the Twigg radiometer, of 43·24 per cent. of the net calorific power of the gas, as against 42·9 per cent. for the "Mascot" fire tested in similar conditions. The Davis's "Apollo" fire in the same conditions as before, as an average of five days' testings, gave a radiation, measured by the "Leeds" test, of 52·73 per cent. of the net calorific power of the gas, as against 52·07 per cent. as the average of five days' testings of the "Mascot" fire. These testings refer to a room temperature of 69° to 70° Fahr., and a gas consumption of 25 to 26 cubic feet per hour, and are strictly comparable for the two fires.

It will be seen that, while the "Leeds" test results are considerably higher than those obtained with the Twigg radiometer, they are, like the latter, practically identical for the two fires. Therefore it may be fairly inferred that the tests made with the Twigg radiometer, already referred to, with the two fires in different conditions of flue draught are perfectly trustworthy for comparative purposes, and that the deductions drawn in the former article from the tests would have been the same if the "Leeds" method of measuring radiation had been used, instead of the Twigg radiometer.

Hence the conclusion drawn in the previous article, that the method of construction followed in the "Apollo" fire is not attended by any falling-off in heating efficiency, is now shown to have been in no way dependent on the particular method of measuring radiation which the writer preferred to use for the tests reported in that article. In the comparisons now reported, both fires were used without flue-pipe. The tests were made by the writer in the laboratories of the Davis Gas Stove Company, at Luton, where both types of radiometer are established.

The writer hopes at some later time to discuss the reasons for the difference between the results obtained for the radiation of the same fire by the two types of radiometer, and to indicate which of them appears to him to be nearer the truth. He is at present collecting further experimental data with a view to elucidating this question.

Illuminating Engineering Society.—The first meeting of this Society for the new session will be held in the rooms of the Royal Society of Arts next Tuesday. The Hon. Secretary (Mr. Leon Gaster) will present a short report on progress during the vacation; and Mr. F. W. Goodenough (Chairman of the Council) and Dr. James Kerr respectively will give some account of the proceedings at the National Gas Exhibition and the Fourth International Congress on School Hygiene, held at Buffalo during September. Subsequently a series of photographs illustrating shadow effects by natural and artificial light will be presented by Messrs. J. S. Dow and V. H. Mackinney.

GAS AT THE ANGLO-AMERICAN EXHIBITION OF 1914.

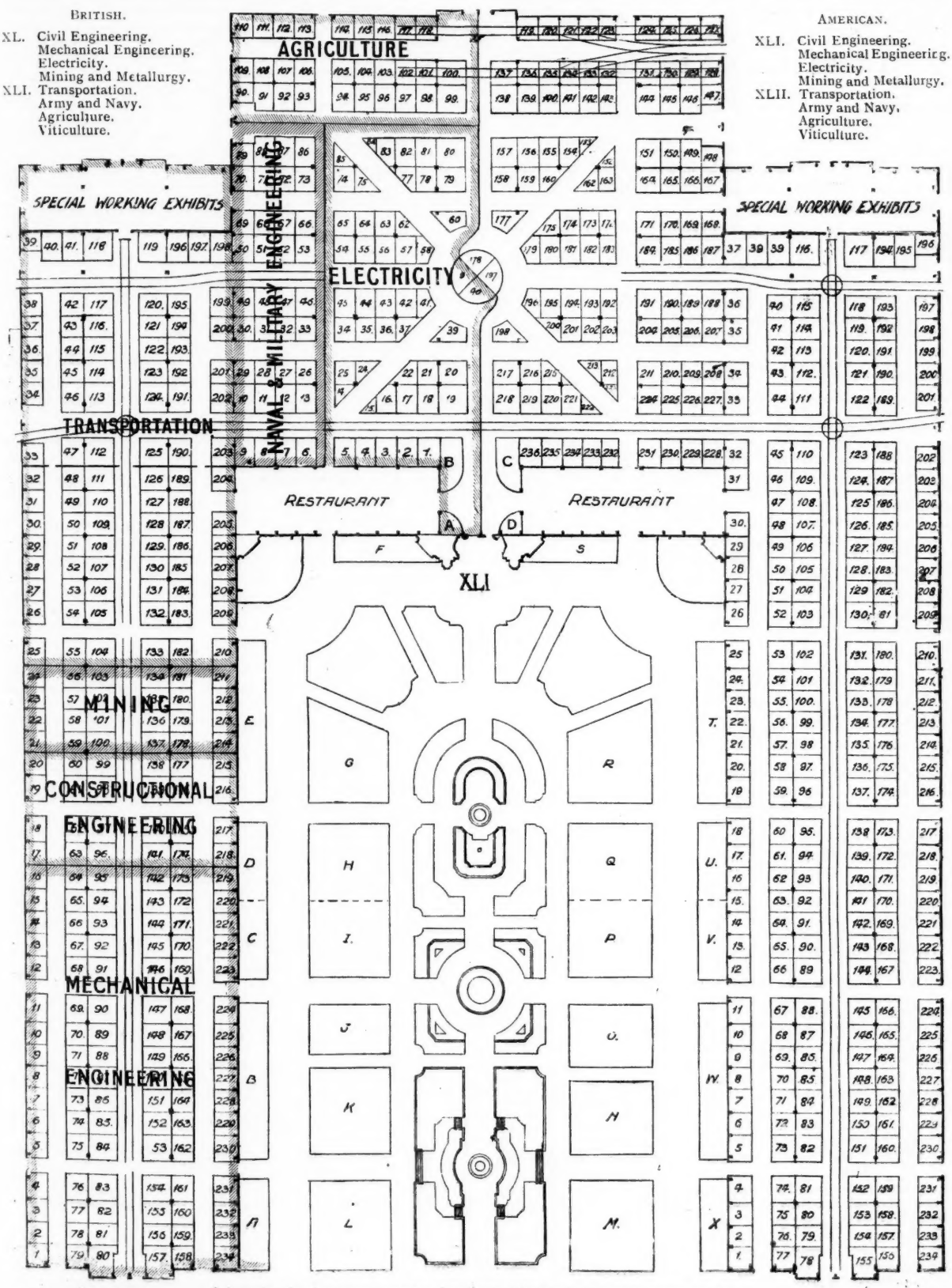
Mr. CHARLES CARPENTER follows up his Recent Speech.

UNDER date of the 5th inst., Mr. Charles Carpenter, D.Sc., M.Inst.C.E., the Chairman of the South Metropolitan Gas Company, addressed the following communication to the "JOURNAL;" and reference is made to the subject in the editorial columns to-day.

Anglo-American Exhibition to Celebrate the Centenary of Peace and Progress in the Arts, Sciences, and Industries of the United States of America and the British Empire, 1914.

SIR,—I attended this afternoon a meeting of the Executive of the Engineering Committee formed in connection with the above, and at which was discussed, among other matters, the allocation of space to the various industries.

In the absence of Sir Corbet Woodall, I inquired whether, in the event of the gas industry desiring to be represented by an



THE MACHINERY HALLS AT THE ANGLO-AMERICAN EXPOSITION, SHEPHERD'S BUSH, 1914.

exhibit, space could be obtained—reminding the meeting that gas supply too had attained its centenary.

In reply, Mr. Imre Kiralfy informed the meeting that the boundaries between certain sections had only been fixed provisionally; and if gas desired to take part in the display, space could be given between, say, the "Transportation" and "Mining" sections.

You will notice from the plan I enclose that the entire block of buildings has been divided into two equal parts—one being reserved for the British and the other for the American exhibits. The electrical exhibit of both nations will be housed in the large central hall, as I stated at the recent White City luncheon.

The matter is one which concerns our industry as a whole; and I therefore seek the publicity of the Press (I am writing by the same post to the President of the Institution) so that the present position may be before it.

Nov. 5, 1913. CHARLES CARPENTER.

LABOUR DISPUTES DURING 1912.

PARTICULARS of an interesting character in regard to industrial disputes resulting in a cessation of work are to be found in the annual report of the Department of Labour Statistics of the Board of Trade on "Strikes and Lock-Outs and Conciliation and Arbitration Boards." The volume for 1912 (which is the twenty-fifth issue of the series) has just been published over the signature of Mr. F. H. M'Leod; and a few figures may now be taken from the first part, which deals with strikes and lock-outs.

In 1911, the transport trades were much "in the limelight" so far as disputes with their employers were concerned; but their performances sink into comparative insignificance when set by the side of the efforts in the same direction of the coal-mining industry in 1912. Of course, the outstanding feature last year was the national coal strike, in which about a million workpeople were involved—or more than twice as many as the total for all other disputes. Both 1911 and 1912 will be long remembered for their labour upheavals; for the aggregate duration of labour disputes in these two years exceeded the total time lost in this way during the previous twelve years. Wages constituted the "bone of contention" in most of the cases. In fact, the proportion of workpeople involved in all wages disputes (86 per cent.) showed a large increase; this being due in a great measure to the inclusion of the coal miners' strike, which was to enforce the principle of a minimum wage. Another 10 per cent. of the workpeople involved in disputes were concerned with questions of trade union principle. This leaves only 4 per cent. for all other causes of dispute.

It is remarked that the stoppage of work in and about coal mines for an aggregate of over 30 million working days, represented approximately 11 per cent. of a year's working time in the coal-mining industry; but owing to increased activity both before and after the dispute, and the great demand for coal in a year of expanding trade, the total output in 1912 was only about 4 per cent. less than in the year immediately preceding. The upset in trading circles caused by the coal strike naturally exercised considerable influence on employment in other industries; and so the percentage of trade union members unemployed rose sharply from 2·8 in February to 11·3 in March. This unsatisfactory state of affairs, however, was quickly rectified when the miners resumed work; and by the end of May the unemployed percentage had returned to the first-named low level. Other disputes not so far mentioned—in the cotton and London transport trades—also occurred in the first half of the year; and though the second six months were comparatively free from these disturbances, the total number of workpeople involved (nearly 1½ millions), and the aggregate duration in working days (which was practically 41 millions) of the disputes in 1912, were much higher than in 1893, which, in consequence of a great coal-mining dispute, had hitherto held the record in both respects. Last year the miners, of course, succeeded in getting conceded the minimum wage principle for which they were striving; and thus the proportion of workpeople who obtained their principal demands was unusually high.

Taking a rough estimate, says the report, the aggregate number of working days available for the whole industrial population (exclusive of agricultural labourers) may be put at rather more than 3200 million; and the aggregate duration of all the disputes in progress in 1912 amounted to 40,914,675 days, or nearly one-seventy-fifth of this total. Of this enormous number of days, no less than 30,800,000 are calculated to represent the time lost in the national coal strike. The total amount of time lost owing to disputes in 1912, at the works immediately affected, would have been nearly four working days per head, if spread over the whole industrial population. In the coal-mining industry, the average loss of time was about thirty days per head; and in the metal, engineering, and shipbuilding trades it was about two-thirds of a day per head. Of the total number of persons engaged in industrial occupations, the proportion affected by disputes last year was 13·4 per cent., compared with 9 per cent. in 1911, and 3·9 per cent. as the average of the last ten years. In the coal-mining industry, the proportion was 93·7 per cent.

Of the 857 disputes which began last year, nearly half lasted less than a week; while 670 were over in less than four weeks. Wages were responsible for 539 of the disputes, good trade giving rise to requests for advances. There were 82 disputes respecting the re-adjustment of rates of payment on account of difficulties in working, &c.; and of these 20 were in the coal-mining industry, and were due largely to difficulties respecting the rate of payment for working in abnormal places. Trade union principles—usually another name for an attempt to eliminate free labour—are, of course, always a more or less fruitful source of disturbance. There were a few demands for some reduction in the hours of labour. Questions as to the demarcation of work between various sections of workers accounted for a small number of disputes in the engineering trade, as did also the alleged employment of labourers on work claimed by skilled men.

Coming now to the results of all this sacrifice of time and money, it is seen that, as already mentioned, the successful outcome of the general coal strike was responsible for a high percentage of workpeople involved in successful disputes. If, however, comparison is made by the number of disputes, the proportions successful, unsuccessful, and compromised in this industry were nearly equal. The highest percentage of workpeople involved in disputes settled in favour of the employers was in the transport trades. In the other trades, the majority of workpeople were involved in disputes settled by compromises or only partially successful. Basing the comparison on the number of disputes, instead of on the number of workpeople directly involved, it is found that the proportions settled in favour of the workpeople, in favour of the employers, and compromised or partially successful, were respectively 27, 30, and 42 per cent. The great coal strike, of course, was settled by the principle of a minimum wage for all underground workers being established under the provisions of the Coal Mines (Minimum Wage) Act; and it is recorded that this is the first case of a dispute occurring in the United Kingdom having been settled by legislation.

WORKS TOPICS.—VI.

BY MODUS OPERANDI.

THE contents of Mr. D. Milne Watson's paper, on the educational scheme of the Gaslight and Coke Company, bear eloquent testimony to the thorough manner in which this large Company train their staff—from the gas-fitter's boy to the future engineers of the Company. They have been quick to see the necessity for this systematized training, and are an object-lesson to other and smaller undertakings which have for the most part done little or nothing in this direction.

TRAINING OF GAS ENGINEERS.

In this column it would be a digression to discuss the training of the district staff; but, fortunately for those on the works staff of the Company, this training is by no means limited to the outside employees. Mr. Watson outlined a most complete curriculum through which the future engineers are required to pass. The training is extended, without premium, to candidates of not less than twenty years of age who have had a thoroughly good education, and who have had a successful practical and theoretical engineering training in some suitable institution. The age of entry is significant; for it is obvious that the Company insist on the material being first-class before entering their service. A public-school education, followed by a couple of years (one year at least) of engineering training in a technical college, is undoubtedly an excellent foundation on which to build up a successful career as a gas engineer. No one will find fault with this except those who, unfortunately for them, cannot provide the means for giving their sons so complete an education. But here the Company come in part to their rescue by charging no premium for their apprenticeship. In substance they prefer the parent to spend in a technical college the premium usually required for an engineering training. In the writer's view, the Company, by adopting this plan, have improved on the usual apprenticeship system. The crux of the whole matter is that they are likely to get better material. The future career of a boy of eighteen apprenticed to the profession is very much a matter of speculation; but, in the case of a specially trained pupil of twenty, the speculative factor is much diminished. So far so good.

The training (three years) of the coming engineer, briefly summarized, is as follows:

- Retort-house, Purification, Carburetted water gas, Testing — At different stations.
- Tar and ammonia products works.
- Mains and services.
- Apportioning of costs and bookkeeping.
- Stove and meter shop.
- Gas sales department: (1) Fixing appliances; (2) Inspector's routine; (3) Show-room.

A more complete training could not be imagined. The scheme, if properly handled, as undoubtedly is the case, should give the Company a staff of engineers second to none, and, further, they will deserve all the success their enterprise and good sense merit.

BREEZE-WASHING PLANT.

The recent report by Mr. J. P. Leather to the Burnley Corporation on the sale of gas-works residuals emphasizes the demand at the present time for an efficient breeze-washing plant of suitable size and price for medium-sized gas-works. As Mr. Leather

states, "the smallest-sized plant would be capable of dealing with a week's production of 'pan ashes' in two days." He does not say whether this is based on winter production, or is merely an average computation based on the annual output. Presumably it is the former, for these plants are made to handle about 5 tons per hour, which provides for treating about 90 or 100 tons of "pan ashes" in two days. This is a large quantity, and corresponds to a weekly production of 600 to 700 tons of coke for sale. A works of this size will make about 800 million cubic feet per annum. Thus this size of plant is really large enough for a works producing 2400 million cubic feet. Mr. Leather proposes to get over the difficulty by using the plant for coke screening as well as breeze washing; but this arrangement would only suit certain cases, and is not what is usually required.

Again, a plant of such large capacity is obviously proportionately high in cost, and it is the annual cost of interest, depreciation, wear and tear, and power on a plant costing, say, £700 that prevents a saving being shown in any but large works. It is but reasonable to assume that the above items would account for an expenditure of fully 20 per cent. per annum on the capital outlay. Thus, an annual charge of £140 must be added to the labour costs on the plant.

It is undoubtedly a fact that there is quite a wide demand for a plant to deal with 10 tons a day, at a price not exceeding £150 to £200. Without a breeze washer, the conversion of furnace pan breeze into good fuel entails no end of labour per ton of breeze; and it is quite common to see two or three men picking over the pan breeze daily in works that are by no means large. A good breeze washer will save 70 to 80 per cent. of this labour, and will, besides, do better work. Therefore, the first contractor who is enterprising enough to put on the market a suitable and efficient plant of small size is likely to reap a rich reward.

It is noteworthy that Mr. Harold Woodall is contributing a paper on "Some Economies in Gas-Works" at the Southern District Association meeting on Nov. 20, including as one item "Breeze Washing." So we may hope soon to learn more of its possibilities. *En passant*, this meeting is likely to be productive of much interest to works engineers; for, in addition to breeze-washing, Mr. Woodall is going to touch on oxide purification and motor haulage for gas-works; while Mr. R. P. Harris, of the Commercial Gas Company, is reading a paper on the "Extraction of Tar and Water Vapour from Carburetted Water Gas." These are subjects well chosen to produce interesting discussions, and it is hoped that members will make good use of their opportunities.

IMPROVING THE FUEL ACCOUNT.—PART II.

By "Works Engineer."

Primary Air Regulators.

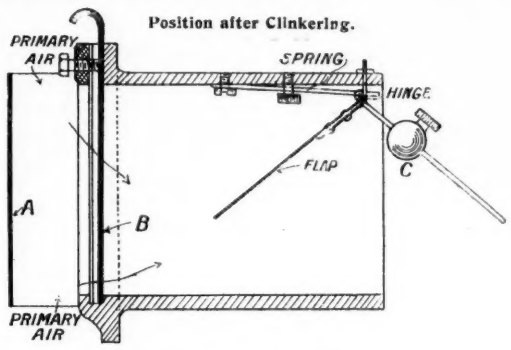
Another new, but very important, method of saving fuel in retort-furnaces is to use Brooke's primary air regulators. This ingenious, though exceedingly simple device, was designed to regulate the quantity of primary air admitted to a furnace whatever the state of the fire or the amount of chimney draught. The apparatus consists of a small cast-iron box similar in design to ordinary flue cleaning boxes. In the box hangs a flap of thin sheet metal. To this flap is attached an adjustable counterbalance weight. Normally the flap hangs diagonally in the box, though the angle varies with the pull on the fire. Through this box, under the flap-valve, passes the whole of the primary air. Should the draught be strong, as is experienced directly after clinkering, the pull of the shaft draws down the flap, and so partially closes the opening until equilibrium is established by means of the counterbalance weight. The latter tends to increase the size of the opening; while the pull tends to reduce it. As the time for clinkering approaches, the pull becomes less and less, and thus the weight exerts its power, opening the flap valve, and so allowing more primary air to enter. The primary air opening is, therefore, constantly varying in size according to the pull.

The economy resulting from the use of this apparatus is quite substantial; while the cost of fitting the arrangement is very small. The writer has had some months' experience of the regulators; and in the initial stage he experimented with two settings—one fitted with the apparatus and the other without it. The test showed that the former setting was using about 6 cwt. less coke per diem than the latter. As normally these settings had been using about 24 cwt. a day in the furnace, the saving was thus the substantial one of 25 per cent. or thereabouts. The same type of apparatus may be used for the secondary-air openings, though it is very probable that the saving in this case will be considerably smaller.

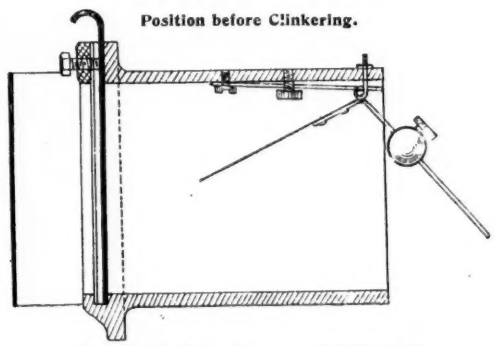
In the sketch here shown, an idea is given of the movement of the flap-valve in a day's working. The variation is not very large; but it is quite enough to maintain hour by hour a constant admission of primary air. The supplementary slide B is, of course, always fully open when the regulator is working. The hinge is merely a hook on which the flap is suspended. The spring is fitted for the purpose of obtaining a more even movement of the flap should it be too lively in working.

Output of Coke per Setting.

An undoubted factor in influencing the make of coke for sale is the output of coke from each setting. A setting that is carbonizing a lot of coal and is, therefore, making a lot of coke, is, in most cases, using less than its share of coke in the furnace. The output per retort depends on a variety of circumstances; but in cases where this output is satisfactory, the conditions are favourable for a low fuel account. A retort that is charged for twelve hours, but which is burnt off in ten hours, is using, and wasting, a certain proportion of fuel—in fact, as much fuel will have been consumed as if the full charge had been carbonized.



A. Wind Guard. B. Supplementary Slide.
C. Adjustable Counterbalance Weight.



BROOKE'S PRIMARY-AIR REGULATOR.

For instance, presuming that it is intended to carbonize 12 tons of coal per diem in a setting of ten through retorts, but that instead of this, owing to bad charging, only 10 tons are carbonized; and assuming, also, that a ton of coal will yield 13 cwt. of coke, of which 2 cwt. are used in the furnaces, then it follows that, if 12 tons of coal are used in the setting, 24 cwt. of coke will be burnt in the furnace. But if, as the result of bad work, only 10 tons are carbonized, the same quantity—namely, 24 cwt.—of coke will still be used in the furnace. In the one case, 12 tons of coal make 156 cwt. of coke, from which 24 cwt. must be deducted for furnace use; leaving 132 cwt. for sale, or 11 cwt. of coke per ton of coal. In the other case 10 tons of coal make 130 cwt. of coke, which, deducting 24 cwt., leaves 106 cwt. for sale, or 10·6 cwt. of coke per ton of coal. The output of coke from each setting has, for this reason, an important influence on the fuel result.

Top Retorts for Filling Furnaces.

Another factor which must not be overlooked is the position of the retorts from which the furnaces are charged. It is obvious that the higher the retort the greater is the breakage of coke in falling to the conveyor, truck, barrow, or floor, where it is required to be deposited. It follows, then, that the lower tiers of retorts will provide the most unbroken coke with the lowest proportion of breeze. If, therefore, these lower tier of retorts are used for filling the furnaces, a large proportion of the coke that remains will have an undue percentage of breeze among it. Far better is it to reserve the top tier of retorts for filling the furnaces, and the lower tiers for sale purposes. By doing this all the best and largest of the coke will be sold. It may be asked, is not the use of the partially broken coke in the furnaces detrimental to their working. The writer believes a good proportion of breeze and small coke intermixed with the large coke is actually beneficial for retort-furnaces, for the reason that there is not so much short-circuiting of primary air, which is especially an advantage when the furnace is low in fuel.

The writer believes that if in cases where the lower tiers of retorts are now used for filling the furnaces, a change to the top tier is made, a very substantial improvement will be immediately observable. In this connection, the writer noticed that at one large works he visited it was a practice to consume most, if not all, of the coke breeze in the retort-furnaces. To do this the breeze was stacked in front of the settings, and when a furnace was being filled, a number of shovels of breeze were thrown in on top of the coke. No detrimental effects in the heats were noticeable, he was informed, and certainly the fuel results at the works were comparable with any in the country. This bears out the statement that a certain proportion of breeze with the coke in the furnaces is actually beneficial. It may be remembered that

Mr. Madden, of Cardiff, in the course of a presidential address to the Wales and Monmouthshire District Institution of Gas Engineers and Managers [see "JOURNAL," Sept. 30, p. 931], described, and recommended, a practice of throwing breeze into furnaces after clinkering, so as to counteract the excessively strong draught always experienced at this period of the daily working of a retort-furnace. It is undoubtedly a wise plan, and has the desired effect. Therefore it is well to bear in mind that it is advisable to use the top retorts for filling the furnaces.

Breakage of Coke—a Factor.

Closely connected with this question is the importance of breaking the coke as little as possible. If it is desired to make for sale 11 cwt. of coke per ton of coal—and who that is making 10 cwt. does not so desire—it is imperative that there should be no undue breakage of coke. It is no consolation to make 1½ cwt. of coke breeze and 10 cwt. of coke, and say that the two together make 11½ cwt. Better far to make 11 cwt. of coke and ½ cwt. breeze. The one result is good, and the other bad. The coke should be carefully treated. Long slanting shoots to conveyor, truck, or coke floor are highly desirable, but are too rarely seen. In horizontal and inclined retort-settings, it is inevitable that coke should be severely treated; but let the treatment be as little severe as possible.

The handling of coke after it is made has an influence on the result. If the large coke is forked into sacks or vans and sold, and the remainder, with which there is undoubtedly a large proportion of coke, is used or sold as breeze, the manager can only blame himself if the result, in figures, looks very bad. For there is, in most districts, a good sale for small coke at a price which compares well with that paid for the large. Is it not, therefore, much better to collect the breeze and screen it into two or more sizes to recover every bit of coke, and sell it as such? The money lost in the breakage of coke is not so severe if the coke, instead of being 3 inches in size, is only ¾ inch, if it is still sold as coke and is not left to be sold as breeze at a low figure. In this connection there is a great advantage in working heavy charges; for the coke is so much harder than that made in small charges that, instead of breaking up into fine breeze, it breaks up instead into lumps of smaller size only. Thus one large lump, instead of breaking up into a score of small pieces with a large proportion of fine breeze among them, will break into two or three smaller pieces, and is still saleable as coke. For this very reason heavy charges are a great factor in strengthening the coke to withstand breakage; thus increasing the quantity of coke made and decreasing the breeze. It is always advisable, therefore, to look into this question, with a view to separating the coke and breeze and selling them as such.

Attending to Furnaces.

The clinkering and pricking-up of furnaces are, of course, important points. If the clinkering be done badly, or at too long intervals, the furnace is doing only half its work. As a consequence an insufficient quantity of primary air is being admitted, while the full quantity of secondary air is passing into the combustion chamber, which must have a very deleterious influence on the heat of the setting. The importance of attending regularly to the furnaces cannot be over-estimated; for unless the correct quantity of primary air is being admitted, the heats cannot possibly be maintained. No rule can be laid down for fixing the intervals of clinkering; it all depends on the fuel in use and the capacity of the furnace for the work it has to do. Some will require clinkering every day, others every two days, and so on; while some will work for a week without clinkering. Whenever the grate is completely covered with (say) four or five inches of clinker, it is time to clinker the furnace. As to pricking-up, three or four minutes spent in this way on each furnace every eight hours will do no end to keep it fully at work. Whenever the grate appears to be black all over, the time for this operation has arrived. The object of pricking-up is, of course, to shake out the ashes which have accumulated in the fire-bars, and to prevent the clinker from forming into a solid mass. The whole idea is to gain ingress for the primary air.

The work of pricking-up should also include the clearing of the fire-bars, so that the drip water may do its work, and the regulation of the flow of water. This work is too often neglected, with the result that the fire-bars last but a short time. The question of the importance of proper clinkering and pricking-up, if good fuel results are to be obtained, is fairly obvious; for anything which prevents the furnace from doing its full duty is instrumental in lowering the capacity of the retorts that it heats. Again, a furnace that is well clinkered, but which is badly pricked-up, will heat the setting adequately for the first twelve hours after clinkering, but during the next twelve hours the charges will not be burnt off. Clinkering should be done as quickly as possible; for great waste of fuel is proceeding while this operation is being carried out. An enormous excess of primary air is passing through the furnace; while the resulting producer gas will be but partly burnt, unless more secondary air is purposely admitted.

Fire-Bars and Pan Breeze.

Some observation should be kept on the amount of pan breeze made by the furnaces. A careful fireman will allow as little as possible of good coke to drop into the ash-pan. Some are very wasteful in this respect. It is advisable to so arrange that the fireman empties his own ash-pans and removes the ashes, as this tends to prevent him from allowing an undue proportion of fuel to drop into the ash-pan. An engineer should satisfy himself that a reasonable amount only of the coke used for fuel finds its way into the ash-pan. The coke here deposited is, of course, again usable; but only after a good deal of labour has been expended in separating it from clinker. Even then its saturated state practically bars it from any other use than as a boiler fuel. The spacing of the fire-bars in a retort furnace is sometimes responsible for the loss of a good deal of fuel, and is a point that should not be forgotten. This space is often too wide, especially when the fire-bars become worn. The false bars used in clinkering should also be placed closely together.

Most of the important points have now been mentioned; and although the ideas are by no means new, but are merely elementary details, they may be instrumental in suggesting possible sources of loss which have been overlooked. The writer, as a manager of works, would himself be extremely dissatisfied with a make of coke for sale of less than 11 cwt.; but at the same time, he is aware that it requires a sharp look-out on details to maintain a standard in excess of this figure.

COMBINING GAS AND ELECTRICITY SUPPLIES.

The Bognor Gas Company's Scheme.

The electric lighting undertaking of the Bognor Gaslight and Coke Company, which was inaugurated last week, though not a large one, is interesting as showing the increasing tendency for gas companies in smaller towns to go in for the supply of electricity as well. Like the Ascot and the Farnham Gas Companies, the Bognor Gas Company have lost no time in getting to work when once they secured their powers; and they are prepared to offer consumers throughout their area the choice of a supply of either gas or electricity.

The Bognor Gas Company decided to promote a Bill giving them powers to supply electricity throughout their area; and in July, 1912, the Act was duly passed. Immediate steps were taken to put the powers into effect; and Messrs. Handcock and Dykes, of Westminster, who had appeared in support of the Bill in Committee, and who had designed stations for the Ascot and Farnham Companies, were instructed to draw specifications and take tenders for the necessary works. They recommended a low-tension three-wire direct-current scheme; the engine-house being placed on the site of the old gas-works, some of the buildings of which were converted to form an engine-room 52 ft. by 43 ft. 6 in. by 19 ft. to the principals. Last week the formal opening of the station took place; current being turned on to the town by the Chairman of the Urban District Council, in the presence of the members of the Council, the Directors of the Gas Company, Mr. Dykes (the Consulting Engineer), and others.

The station plant consists of one 120 B.H.P. Diesel engine, direct coupled to an 80 K.W. Electric Construction Company's direct-current generator, to give 450 to 483 volts, and one 50 B.H.P. Diesel engine direct coupled to a Dick-Kerr 33 K.W. direct-current generator; ample space being left for additional sets to be added as required later. The circulating water for the engines is provided by means of a cooling tower situated in the gas-works yard outside. The balancer booster is by the Electric Construction Company, and consists of two balancer motors and two booster dynamos coupled together on the same bedplate. The boosters are reversible, and give 100 amperes at any voltage from 10 up to 80; and the balancers will deal with an out-of-balance current of 48 amperes.

The switchboard, by Messrs. Middleton, of Westminster, is mounted on a raised platform, and consists of nine marble panels carrying the necessary instruments for controlling the machines, balancer boosters, battery, and feeders. The necessary regulating resistances are all fixed in the space below the switchboard, and are actuated from the switchboard platform by means of a pedestal handwheel. Next to the engine-room there is a very commodious battery-room, containing in a single tier 240 storage cells by the D.P. Battery Company, of a capacity of 54 amperes for ten hours, and capable of supplying the whole of the lights in the town when the engines are not running.

The whole of the underground mains have been supplied by Messrs. Siemens Bros. and Co., of Woolwich. They consist of three-core cables insulated with paper, lead covered, and armoured with double steel tape, and then covered with jute impregnated with compound, and laid direct in the ground. Between 7 and 8 miles have been laid. Very neat switch control pillars have been fixed at various parts of the town, so as to bring the whole of the connections, switches, and fuse-gear above ground, and do away with underground boxes, which are always liable to give trouble in the event of flooding. The system of supply is three-wire, 220 volts on either side of the system; the lights being supplied at 220 volts, and large motors at 440.

The number of consumers connected to the mains on the opening day was 70, representing about 4138 16-candle power 20-watt lamps; and it is anticipated that this number will be considerably increased now that the new station is at work. The price charged for private lighting is 6d. per unit; the maximum allowable under the Order being 8d.

THE GAS INDUSTRY AND CO-PARTNERSHIP.

PAPERS AND DISCUSSIONS AT LEEDS.

At the Meeting in Leeds last week of the Labour Co-Partnership Association, two papers were read by Mr. Charles Carpenter, D.Sc., and Sir Corbet Woodall, D.Sc., on the subject of co-partnership, viewed more particularly from the standpoint of the gas industry. The principal portions of them, and a report of the discussion, are given below.

On Friday evening, under the auspices of the above-named Association and the University Society for Social Study, a full meeting was held at the Leeds University under the presidency of Mr. A. G. Lupton, LL.D., the Pro-Chancellor.

The Chairman, in opening the proceedings, spoke briefly of the urgent necessity of finding better means than those at present usually adopted of settling the shares which capital and labour should have in the product of industrial operations.

Mr. Charles Carpenter, D.Sc., delivered an address on

CO-PARTNERSHIP AND INDUSTRIAL EFFICIENCY.

He said that the ideals of industry might be typified by the words "progress" and "efficiency;" and these involved the combined efforts of capital and labour. In spite of the wonderful progress which had been made in industrial mechanism, this would all come quickly to a standstill were it not for the efficiency of labour; and in a very large degree this depended upon its being in a state of contentment. The workers were one and all asking to-day, "Are we getting our share of the wealth in the creation of which we play so important and necessary a part?" Practically, in the normal conditions of wage employment, one and all replied in the negative. Thus there was in this condition something more than the minimum of friction which must be the ideal if thoroughly satisfactory results were to be obtained. Co-partnership reduced the friction to the minimum in a way which he would attempt to describe. The co-partnership employer paid the ordinary hire rates for labour; but, finding that the willing worker might be worth much more than the usual market product, he arranged that, after providing that a fixed percentage should be paid upon the capital employed, he offered to share the profits made over this amount by dividing them between himself and his workpeople, reckoning their wages as their capital in the undertaking.

Mr. Carpenter then took three typical cases by way of illustration: Suppose an undertaking with a capital of £100,000 earns (say) £11,000 profit per annum; £5000 of this is allocated in payment of interest charges at 5 per cent. on the capital, and the remainder is divided in equal percentages to capital and labour. If the cost of wages per annum were £100,000, then the share of both would be equal in amount; that is to say, £3000 to each, or at the rate of 3 per cent. But suppose the wages only equalled £50,000, the profit remaining the same, labour would get £2000 as its 4 per cent., and capital would get £4000 as its 4 per cent. Again, if the labour costs were £200,000, the surplus could only be appropriated on a 2 per cent. basis; £4000 going to labour and £2000 to capital. Case No. 1 is easily understood, because it happens that the amount of the extra profit is shared equally.

Case No. 2 is typical of the railway, gas, and water undertakings, &c., where the capital spent on land and fixed plant is very heavy indeed, in comparison with case No. 3—building yards, for instance—where the heavy cost is for labour, and land and plant charges are comparatively small. But the principle is the same in all three instances—viz., payment of profits in an equal percentage to both capital and labour; the amount earned by each being greater or less according to their respective proportions and relationship to the working costs.

Continuing, Mr. Carpenter said: Such is labour co-partnership. Examples of it may be found all over the country; and an experience of it of just upon a quarter-of-a-century supports in me the firm conviction that neither employers nor employed who have once tried it fairly, and enjoyed its blessings, would ever go back to the older basis of working. It is true there have been failures—notably that of the Furness yards; but this instance, which is so often quoted, never was a co-partnership system in the sense in which I understand the term. The reasons why co-partnership has not made greater progress are the opposition of the trade unions and the apathy of employers. The true spirit of Trade Unionism is not in any way interfered with by co-partnership; and the employers' indifference is bound to diminish as it is more and more clearly recognized that the present condition of things cannot possibly continue, and that the true remedy for the present unrest is to cause the worker, not to have more work ground out of him, but to take so intelligent an interest in his work, and be so concerned in the well-being of the undertaking, that he will minimize the waste of time and materials which can so easily occur in any industrial undertaking. Neither a home nor a state can stand divided against itself. Yet does not this describe the industrial state as it very largely exists to-day.

One of the most earnest advocates of co-partnership was the late Sir George Livesey. He was a keen business man of quite the North-country type; the great ambition of his life being to sell cheap gas in South London. Co-partnership with the employees was one of his great aids in achieving this; and for many years he was able to prove, by undeniable figures, that his Company's results were much more satisfactory than those of others working under precisely similar conditions, but without co-partnership. The basis of comparison gradually disappeared when at last other gas undertakings woke up to the advantage of, and adopted, his principles. The industry for which he worked showed its appreciation of his principles and his work by founding a Chair of Technology in this important University, and further by so following in his footsteps that to-day 35 gas companies, with a total capital of 51½ millions, are working under co-partnership principles.

"Oh!" it is said, "it is all very well for gas companies; you always make profits, and you are monopolists into the bargain." I can give one interesting case where the bonus payable to the workmen fell from 9 per cent. in one year to 3¾ per cent. the following year, owing to diminished profits arising from the increased cost of raw material. How did the workpeople accept it? Cheerfully and with a good spirit, saying they would do what in them was possible to help to tide over the deficiency. It is quite a mistake to suppose that gas undertakings do not suffer from competition. The South Metropolitan Gas Company—Sir George Livesey's old company—for instance, has to compete with five electricity supply companies and four municipal electricity supplies; and co-partnership has been of untold help in enabling it successfully to withstand, despite such a heavy handicap, the onslaught made upon its business by such powerful competitors.

Livesey was little of a theorist, but a practical man, advocating a remedy for an evil which he saw was sapping the vitality and checking the activity of industrial life. And for a quarter-of-a-century the Company whose destinies he had guided so ably has enjoyed the inestimable blessing of industrial unruffled peace. When trade in the Port of London was at a standstill during the great strike, the Company's tugs and barges went their accustomed way upon an otherwise deserted river; its carmen delivered coke and gas appliances to its usual customers when the transport workers all around it were idle. And thus, unhampered by labour troubles, its officials have been able to devote their whole energies and their entire resources to increasing the popularity of gas by improved methods of production, and by the more intelligent application of its uses to solidify and strengthen the foundation upon which their business stands. Just as patriotism animates a nation, so co-partnership can permeate a manufacturing company with its animating force, and bring back to the soulless mammoths of which industrial life is now so often composed the very same spirit of brotherhood and fellowship which animated master and man before the factory system turned so much of its mankind, and womankind too, into dehumanized units of a vast mechanical organization. This, then, is the co-partnership ideal, efficiency inspired by hope and contentment. Industry can desire no higher one; and the path of co-partnership is, in many sincere opinions, the only one by which it will be reached.

In conclusion, I would deal briefly with one outcome of co-partnership about which controversy still lingers. On the Boards of two Companies of which I have the honour to be a Director, there sit in the one case three, and in the other two, colleagues elected by the co-partner employees in the undertakings. Everyone engaged in these respective undertakings has a chance to be one day associated with its management; and of those who have been chosen during the fifteen years over which my experience extends, I can unhesitatingly say they have been in every way a credit to themselves and those they represent.

In the discussion which followed, Professor D. H. Macgregor of the Leeds University, said he quite approved of co-partnership for economic reasons; Mr. J. Wale, of Leicester, from the point of view of the participating workman; and Mr. G. Thomson (of Huddersfield) and Mr. T. C. Taylor, M.P., from the textile employers' standpoint.

The Half-Yearly Meeting of the Labour Co-Partnership Association was held on Saturday, at the Albert Hall, Leeds, when there was a very large attendance, chiefly of the co-operative and better working-class people of the city. The chair was occupied by Mr. W. Middlebrook, M.P., and a number of influential people from many parts of the country occupied the platform in support of the movement.

Sir Corbet Woodall, D.Sc., read the following paper:

CO-PARTNERSHIP AND THE PUBLIC GOOD.

This is the third time I have had the honour of addressing the Labour Co-Partnership Association. I am asked to express my views on the place and promise of the principle of co-partnership in, and in relation to, the industrial activities of our country,

because, as I presume, I represent an industry which affords many examples of its application.

In the first place, then, it is my pleasant duty to report that all is, so far, well with co-partnership in the gas industry. There has been no going back upon the endeavour, though fresh adherents arrive less rapidly than could be wished. I do not look upon this slowness at the present time as chargeable to the principle itself, so much as to the prevalence throughout the country of unsettled industrial relations. Amid the conditions existing to-day, not so much in respect of gas workers and the associated labour in and about gas-works as among the various ancillary operatives, it may well appear to many sympathizers with our ideals that this is not the most propitious season for the disturbing of established arrangements.

I would not have it thought that, where the principle has been adopted in the gas industry, all difficulties have immediately vanished, and every expectation formed by those who believed most firmly in the plan, and put it upon the most liberal footing, fulfilled. Human perfection is a plant of slow growth, and there is much yet to be learned. I see no reason, however, why we should waver in our conviction as to the soundness of our principle because a few, or even many, of those for whose immediate and ultimate benefit we are striving, are disposed to grasp the former, with imperfect trust in the latter.

Proceeding, Sir Corbet asked whether all is well with our beloved country on the industrial side, and remarked that to ask is to find the answer from all directions in an emphatic negative. The well-intentioned action of the Government of the day in adding a Labour Department to the Board of Trade has provided machinery for dealing with disputes which have arisen; but contentment is as far to seek as ever. He ventured to suggest that the root and origin of whatever is evil in the existing state of things is to be sought in the limitation of the parties in these quarrels to two. There is, however, the third party—the country itself—to be included in the causes at issue. What is wanted more than everything else in the industrial world just now is a sense of the duty of working for our common country. He asked whether it is possible to measure what would be the gain to the public good if industrial warfare could cease, and capital and labour both together were able—

> To take broad and unselfish views on the political questions of the day.
>
> To combine their forces against admitted industrial and social wrongs, such as sweating and overcrowded and insanitary houses.
>
> To use for the social and educational betterment of the workers the money now lost in warfare, or held up in the war-chest.

The great *desideratum* is to find a common ground on which capital and labour can rightly rest content; and such a ground will be found when each side is convinced in mind and conscience that it is getting and giving justice. Referring to the suggestion made at the last Trades Union Congress, that the needs of labour would be better met [than by a proposed 5s. rise of weekly wages] by "such a reduction of the hours of labour as should effect a direct lessening of the productive capacity of the raw material," the author said we ought to try and ascertain how and why such an idea, utterly opposed as it is to reason, ever arose and found some adherents. There is at the present time, he added, too much of crude materialism in the air. After quoting some remarks made by Lord Selborne last summer, Sir Corbet continued as follows.

It is waste of effort to blame the selfish outlook of the workman unless we are ready and willing to show him a larger one. It is impossible to cavil at the heresy that all the gains of industry belong of right to the workman, if we ourselves fall into the error of thinking that the worker for wages has no rights in the fruits of his toil and fidelity which capital is bound to respect. The employer who scraps his ageing workers, mental or manual, the moment he finds that new ones will come cheaper, is no better than the perverse waste of materials and time. Both can show a patent, materialistic excuse for their actions; but the light of reason that is in them is darkness. Both, moreover, I maintain, are traitors to their country.

We co-partners believe that there is something to be said for the policy of leading men on the way to a high ideal in the best interests of their country and their industrial community, through their pockets. We are not ashamed of the plain money basis of our patriotic and social structure. Opinions and judgments in the world's affairs which those professing them are afraid to support with their money, are not generally highly esteemed. It is the exception of co-partnership to be suspected in some quarters because it is so supported. Why do you do it, critics inquire, if you find it necessary to start it with money down? My answer is, because it holds the field as a remedy for any reasonable labour unrest, and at the same time is a means of enabling the capitalist to do justice to his assistants in the profitable employment of his resources, and, eventually, as a way of educating the people at large in the true understanding of the sources of worldly wealth, such as enterprise, honest toil, the finding of markets, and holding them by equitable dealing. Co-partnership, further, is not a more or less Utopian suggestion; it is a realized ideal.

What is the alternative? This question was put when the subject was discussed at the Birmingham meeting of the British Association on the invitation of Mr. Charles Carpenter, with no better result than a half-hearted agreement that co-partnership cannot be applied to all industrial undertakings. I do not say that it can, as a formal system. I do say, however, that in this regard, as in most other dilemmas, "where there's a will there's a way." Those whose consciences approve the justice of the principle will discover ways and means of applying it, either formally or otherwise. The hindrance which we have to overcome at all costs is the pernicious error that divides the interest of the employer from that of the employed. It was said in Birmingham that there exists "a deep-seated divergency of principle between Capital and Labour" which involves as of necessity the enrolling of employers and employed in opposing and antagonistic camps. According to this dictum, our national house is hopelessly divided against itself, and it is needless to say what the end must be.

It was further argued that trade unionism and co-partnership cannot exist together, and again that "collective bargaining" is the only resource of workpeople engaged in the staple industries. Apart altogether from the very awkward collapse of this method, which has paralyzed so many trade unions lately, it should surely be apparent that the purpose of co-partnership and collective bargaining is one and the same—namely, to assure the labourer his just hire. The wage system is supposed to provide the worker with a fair recompense for his toil; but the estimate is affected by the presence or the absence of competition by other willing hands. In the result, the rate of wages is decided more by the latter consideration than by the value or profitableness of the labour to the employer. If you want a professor or a stoker you must pay enough to get him, which has no necessary relation to his worth. All the individual or collective bargaining in the world will not avail against the effect of competition. Trade unions know this very well; and they do their best to deal with it. Therefore, when all is said for it, collective bargaining is rather preoccupied with the internal regulation of the labour market, than with any solution of the ultimate problem of the fair adjustment of the economic value of labour. Here is where the co-partnership principle comes in, formally or otherwise, as the case may be. The principle, as I understand it, lies in admitting the employee to a share of the profit of the employment, giving the worker, whether by brain or hand, a direct substantial share in the profit he helps to produce, over and above his wages at fair value.

In this system, any mistake in the current rate of wages tends to correct itself. If the share of labour could be more, it receives a bonus; if the whole concern fails to earn a fair return on the invested capital, there is no surplus to divide. I contend that by this agency the labourer gets an education in the origin of wages and profits alike, which cannot but redound to the ultimate advantage of the country. It is the most direct method, as it appeals to me, for restoring to all concerned in industrial production the perception that we are all members one of another. Collectively, co-partnership makes the whole body of men in any business where it exists active working partners in the concern; and when men realize that this is the case, they will not readily, as their collective stake in the business grows, declare war against their own property.

It has been the good fortune of the gas industry of this country to be specially adapted to the application of this principle by the expansion of its peculiar sliding-scale of rates of dividend and selling price of gas. I want the appreciation of this arrangement to possess the public mind, because few people outside the industry know anything about it. The cheaper we can sell gas the higher the rate of dividend we are permitted to distribute. What we have done in addition has been to admit the employees as a third party into the plan; so that when the price is reduced they benefit by increased bonus as the shareholders by larger dividend. The reduction of the price of gas must precede by a half year any increased distribution to either proprietors or co-partners. Therefore, unless the Company can earn the whole amount of increased profit represented by all these sums, the latter two cannot be distributed. I have been particular to explain this sliding-scale and how it operates, because it shows how the gas industry actually realizes the principle that increase of the output is the true source of increased profit and at the same time of cheapened sales.

A hindrance to the extension to other staple industries lies in the widely prevalent belief that large profits need high prices—a belief no doubt strongly held at the present moment by the coal-owners and workers who are enjoying for a season large profits and high wages at the cost to the community of dearer coal.

Concluding these remarks, feeble and imperfect as I know them to be, I would repeat that industrial unrest is largely the expression of resentment against a condition of things under which the working half of the industrial partnership does not get its fair share of the profit produced. It is the heritage of many generations, and may take many more to remove; but the influence of co-partnership upon the public good will perhaps be more marked through the individual than through the mass.

What has been the position of the ordinary worker in the past? He received wages more or less according to his skill or the nature of the business, but rarely more than enough to keep himself and family, and with care and self-denial to save a little for old age; and at the end of life, what he had to look forward to in most cases was to hold on to work to the last possible hour and then live barely on inadequate savings supplemented by the help of his children or others. What is his position under co-partnership? There is being saved up for him yearly a really substantial sum which, at the end of his period of service, will set him free from

work with some hundreds of pounds at his disposal, and his future comfort assured.

I trust I have given some reason why co-partnership may be regarded as containing within itself the germ of a larger hope—that as it brings combined labour to realize that it is being treated as an equal in the industrial scheme, it will broaden and brighten the outlook of the individual and cannot fail to be a potent factor in increasing the public good.

At the close of the paper,

The CHAIRMAN invited questions, and several were asked with particular reference to co-partnership in the gas industry.

Sir CORBET WOODALL, in reply, said it was not true, as a questioner had suggested, that the South Metropolitan Gas Company's scheme had been unsuccessful, and was in antagonism to Trade Unionism. The scheme was objected to by the workers in the first instance, and cordially accepted by them afterwards. Lord Furness's scheme, on the other hand, was not at all of the same kind, and had the disadvantage that in times of bad trade the workers were not able to recover the money they had invested in the undertaking. In regard to all the co-partnership undertakings of which he had any knowledge—and he was personally associated with about half-a-dozen—these had all thoroughly satisfied both the workers and the employers. The scheme of the Gaslight and Coke Company was one under which, starting with certain standards of price, for every penny the price of gas was reduced three-quarters per cent. was added to the wages of each employee. In the case of a man earning £2 a week, this would mean an advantage of more than £5 in the year, calculated at the present price of gas. In answer to an inquiry as to the position of a man at the end of a period of service, he could not give exact particulars, but a labourer with 28s. a week would have about £300 after he had served the Company for about 35 years. If this appeared to some of those present to be a small amount, they would please bear in mind what it was to a man who probably throughout the whole of his working life had never been in command of a £10 note. When at the end of his working career such a man went to one of his relatives in search of a home for the rest of his days, he was welcomed by those to whom he went, not from any merely selfish reason, but because they in all probability had as much as they could do to keep themselves going; and, owing to the co-partnership scheme, he went to them able to contribute enough to prevent his being a burden. In a co-partnership scheme, the workman contributed nothing at all in money, and risked none, but nevertheless interest was accruing to his credit; and, generally speaking, the sum standing in his name was paid to him when he left, even if he only remained a short time. As the profits of an undertaking went up, they were divided fairly between the capitalist and the labourer.

Mr. H. DANIELS, the Manager of the Kettering Co-Operative Clothing Society, and Mr. MANN, the President of the Leicester Anchor Boot Society, spoke enthusiastically in support of the co-partnership principle.

Mr. CARPENTER said he wished to correct a wrong impression which was evidently in the mind of one gentleman, and might exist in the minds of others, in regard to the South Metropolitan Company's co-partnership scheme. The initiation of the scheme was not against Trade Unionism at all. The late Sir George Livesey, in 1872, proposed to the Directors a scheme of sharing the profits, and the Board said they could quite understand the officers having a share of profits, but they did not see their way to giving the men anything. In 1889, the year of the great dock strike in London, there was discontent among the gas stokers, and Sir George again brought his scheme before the Board, and they agreed to it; and it was put forward to the men. It was accepted by the Steam-Engine Makers' Society, the Amalgamated Society of Engineers, the Society of Carpenters and Joiners, the Smiths and Hammermen's Society, and all the other many societies of trades that a large gas undertaking had to employ except the carbonizers. They talked about it, and the result was the Union got orders not to accept it; and that was the cause of the strike. After this was over, the President of the Union said: "We made a mistake. We gave a week's notice. What we ought to have done should have been to have downed our tools; and next time we will down tools without giving a week's notice." Then the Company said that if this was what the Union was going to do, they, on their part, would not employ any of the Union men if they knew it. This was only natural. Any body of men responsible for the conduct of a large undertaking would have had to do something of the kind. But these difficulties had long since disappeared; and the proviso with regard to men belonging to the Gas Workers' Union had been withdrawn for many years. He should like to take an opportunity of answering a question put to him after the meeting on the previous day, when he had to leave. Take the case of a gas-fitter, earning 9d. per hour, who was sent to a house to attend to something wrong with a gas-cooker, found the fault, and put it right; and in order to convince the lady, offered to make, and did make, a bit of toast to satisfy her, and make her feel that he had made a thoroughly good job of it. Then perhaps the lady would say the gaslight was so bad that she was thinking of having the electric light put in. The workman would suggest to her that if she would be advised by him and his employers about the light she would become just as well satisfied with that as she was now with the stove; and he would tell her of the burners and mantles that they had which would bring to an end any difficulty she had had. This was what a co-partnership workman would do in ordinary circumstances; and such a workman had double the value of the other kind. His questioner of the previous day wanted to know why, if the man was worth twice the wage, the employer did not double it. This seemed a natural question; but there were difficulties which the questioner had not foreseen. First of all, when there were hundreds or thousands of men working for an employer, it was very difficult to know exactly which of them were working for him with the sincerity and whole-heartedness he had illustrated. Secondly, if they should discover the men, it was not always very easy to give them all such work as would enable them to render this service of the gaining or retaining a customer who might otherwise be lost. Then a man of the 9d. an hour sort and one of the 1s. 6d. an hour kind might have to go together to the same job; and they all knew how impossible it would be to have two working men of a like denomination working together, and one getting twice as much as the other. By contrast with a situation which presented such difficulties as these they had the position where all the workmen of a place were put on the co-partnership basis, and the undertaking as a whole, and all the working men connected with it, would benefit by the fellowship, good-will, and helpfulness that all these men, in their daily avocations, could apply. They were not actually expending any more energy, but were working with their hearts as well as with their muscles. This was co-partnership; and it had been of enormous benefit to the gas industry, both to capital and labour. But it was not in the least degree by sweating that the gain was obtained. They should remember this also, that the labouring co-partner was the man who first benefited. The employer might or might not get additional value; but the workman had his additional bonus with certainty. In the case of the South Metropolitan Gas Company, the percentage was 8¼; and they had a great many men who had £200 or £300 to their credit. He did not believe that the discontent of the present day among the labouring classes was due so much to the amount of remuneration they received as to the fact that they were profoundly dissatisfied to think that they had no share whatever in what they produced by their muscle beyond the wages which kept them alive. He spoke from practical personal experience of the effect on the minds of the workmen produced by their participation in profits as co-partners. Twenty-five years ago he managed works under the ordinary principle; and then the principle which the average man applied was that he was helping his interests best by doing as little as he could for his money. It was the fashion then to "down tools" on the slightest possible excuse. He managed this same works afterwards under co-partnership principles; and the change was magical. The men felt that they had an interest in what they were doing, and that the more they could help on the prosperity of the undertaking the more they would benefit thereby. His Company had allocated to the workers in co-partnership bonuses more than half-a-million of money. [Applause.] This spoke for the success of the co-partnership principle as it was understood in South London. Some time ago, he was told that they were losing many of their best men—that, having got £60, £70, or £80, they were going out to Canada or Australia. He did not regret this. It was a good thing for working men to be able to leave Great Britain and find in the Colonies the chances which, owing to circumstances into which he need not go, were not possible in this country. It was co-partnership which made it possible for them to avail themselves of these chances.

Further discussion followed, in the course of which co-operators, trade unionists, and socialists gave expression to many variations of creed as to the rights of the labouring man in regard to the results of the industrial output.

An Echo from the National Gas Congress and Exhibition.

A correspondent writes: It was not everyone who noticed in the garden illustrating the propaganda work of the Sulphate of Ammonia Committee a garden seat upon which was inscribed along the back rails, the last verse from a sacred song entitled "God's Garden." The words are by D. F. Gurney, as follows:—

> The kiss of the sun for pardon,
> The song of the birds for mirth—
> One is nearer God's heart in a garden,
> Than anywhere else on earth.

Those who did observe it were impressed with the appropriateness of the words for a garden seat.

At the autumn general meeting of the Society of British Gas Industries, which, as already announced in the "JOURNAL," will be held at the Trocadero Restaurant on Thursday, the 20th inst., under the presidency of Professor Harold B. Dixon, F.R.S., the Chairman of the Council (Mr. W. D. Helps) will read a paper entitled "Thoughts by One Who Thinks," which will be followed by a discussion.

It may be remembered that Messrs. Edwin A. Mansfield and Co., of New Brighton, Cheshire, had on view at the National Gas Exhibition one of their wireless pipe locators, of which particulars have appeared in the "JOURNAL." The appliance, which, it is claimed, will locate the position of metal pipe of any length up to 20 feet deep prior to digging for it, has been subjected to a very arduous test at the hands of Professor Henry Adams and Mr. Tyndale, of the War Office Building Department; and, as the result, the Royal Sanitary Institute have decided to award Messrs. Mansfield their bronze medal and certificate of merit.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

THE Autumn General Meeting of the Association was held last Thursday, at the Grand Hotel, Birmingham —the PRESIDENT (Mr. W. S. Morland, of Gloucester) in the chair.

MINUTES CONFIRMED.

The HON. SECRETARY (Mr. W. W. Townsend, of Hereford) read the minutes of the last two meetings; and they were confirmed.

LETTERS OF APOLOGY.

Two or three letters of apology for non-attendance were read—one being from the President of the Manchester Institution (Mr. F. C. Belton, of Chester).

THE LATE MR. J. BRAITHWAITE.

The PRESIDENT said it was his sad duty to propose a vote of sympathy with the relatives of the late Mr. J. Braithwaite, of Wrexham, who had passed away since their last meeting. They would all agree with him that they should pass such a vote; and that the Secretary should forward a copy of the resolution to the relatives of their late friend.

Mr. T. BERRIDGE (Leamington) asked to be allowed to second the resolution. Mr. Braithwaite was a man who had risen from the ranks; and he was a kind-hearted man. He did a great deal for his assistants, men, and boys. No one, in fact, took greater interest in the young men with whom he was brought into contact; and he (Mr. Berridge) admired him exceedingly. It was only right that a vote of condolence should be passed with the relatives. Mr. Braithwaite was one of the right sort, and one who would be greatly missed.

ELECTION OF OFFICERS.

The PRESIDENT said the next matter was the election of officers. There were no nomination papers received; and so it was left to the President to make the nominations. The result was as follows:

President: W. J. R. Baker, of Mansfield.
Vice-President: C. H. Webb, of Stourbridge.
Hon. Treasurer: W. R. Cooper, of Banbury.
Hon. Secretary: W. G. S. Cranmer, of Willenhall.
Committee: F. Lee, F. J. Ward, and H. J. Woodfine.
Auditors: P. G. Winstanley and G. Stevenson.

[The following retire from the Committee under Rule 4: Mr. W. Langford, as Past-President; and Messrs. W. A. Sapey, W. G. S. Cranmer, and H. E. Copp, as Ordinary Members.]

Arising out of this announcement, the President added, some members might wonder why the Association were unfortunate enough to have to change their Hon. Secretary again. The explanation was that Mr. Townsend had received promotion which would take him out of their part of the country; and he had had to reluctantly sever his connection with them. He was sure they would all join with him (the President) in congratulating Mr. Townsend on the promotion. They were sorry, as an Association, he was leaving them, because he had been an excellent Secretary, although he had only had about a year's experience. They wished him the utmost success in his new sphere of professional activity. Mr. Cranmer had been nominated for the position; and he had very kindly consented to take the office. They all knew Mr. Cranmer well enough to be sure he would fulfil the duties very efficiently. The President-elect, too, they might also congratulate upon his transference to Mansfield; and, while doing this, he would like to congratulate Mr. Jones, of Brierley Hill, who was present, upon his recovery from his very severe accident.

There was some little discussion, initiated by Mr. A. T. Harris (Market Harborough), regarding the distribution of nomination papers a month prior to the autumn meeting. He thought that something of the kind should be done, so as to increase the members' interest in the Association. The selections made by the Committee, in his opinion, were admirable; but he thought his suggestion would broaden the basis of representation. It was mentioned by the President that Mr. Cranmer, before he had any knowledge of the possibility of becoming Hon. Secretary, had given notice of motion to the effect that a post-card should be sent to members early in September reminding that nominations should be received by Sept. 30. Mr. Copp stated that during the four years preceding the present one notices were sent out—both nomination and balloting forms—but they were not used to any reasonable extent. Mr. Harris was quite satisfied with the suggestion embodied in the motion of which Mr. Cranmer had given notice.

The nominations for office-bearers were duly confirmed.

VOTE OF THANKS TO THE RETIRING SECRETARY.

Mr. W. LANGFORD (Longton) said he thought they ought to express their appreciation of the kindness of Mr. Townsend in coming forward and serving the Association, though only for a short period, in the office of Secretary. They were losing an excellent member of no mean talent; and they looked forward to his future with great pleasure and hope.

Mr. GEORGE HELPS (Nuneaton) seconded the motion; and added his hearty congratulations on Mr. Townsend's new appointment.

The motion was cordially passed.

Mr. TOWNSEND said it was very good of the members to pass a vote of thanks to him, after he had been in office only twelve months. When he took the office, he had no intention of leaving Hereford so soon after he was called to the position of Hon. Secretary of the Association. He had been more than repaid for the trouble and work (and there was a good deal of work attaching to the secretaryship) by the personal friendships he had made, and the kindness he had had from all. He was only sorry he had to give up the work just as he was beginning to like it.

PAPERS AND DISCUSSIONS.

Two papers were read, and gave rise to good discussions. The first was by Mr. C. H. WEBB (Stourbridge) on "Dehydrated Tar for Roads," and the second was by Mr. W. M. VALON (Stafford) on "Gas Supply to Outlying Villages." The papers, with full reports of the discussions, appear in other columns of this issue.

At the close of the discussions,

The PRESIDENT said he wished to propose a vote of thanks to the authors for their interesting papers, which had excited such good discussions. Both papers and discussions had added very much to the knowledge of two important subjects.

Mr. F. SHEWRING (Droitwich) seconded the motion, which was heartily agreed to.

COMMERCIAL SECTION.

The Special Committee appointed to consider the question of the formation of a Commercial Section reported as follows:

Your Committee report that they have unanimously approved the following scheme as a basis for the formation of a Commercial Section.

(1) Members of the Midland Association of Gas Engineers and Managers only shall be eligible for membership of the Commercial Section, provided that any member unable to attend the meetings in person may nominate another officer of his undertaking to attend in his place.

(2) The subscription shall be as follows: Works up to 25 millions, 10s. 6d. (Ten shillings and sixpence) per annum; Works above 25 millions, £1 1s. (One pound one shilling) per annum.

(3) An Honorary Secretary shall be appointed, whose duty it shall be to keep the accounts, to collect information from the members, and to tabulate it for their information.

(4) Monthly meetings shall be held in Birmingham, at which all matters referring to the commercial side of the business may be discussed.

(5) Each member shall send to the Hon. Secretary a fortnightly return stating the stock of coke at his works, the net prices, the quantity of surplus for disposal, the present net price for contracts, and also net prices for running contracts. The Secretary shall tabulate these and post to each member. Upon the tabulated list each works to be known only by a number, the key to which shall be supplied by the Secretary to each subscribing member.

(6) Information respecting other residuals shall be exchanged when required.

(7) The general management of the Commercial Section shall be in the hands of the subscribing members, who may form Committees or Sub-Committees to deal with any special matter, and may adopt such rules with regard to the business as a majority of the members shall approve, provided that an annual report be presented to the Association setting forth the work done during each year, and the financial position of the section.

Your Committee have much pleasure in announcing that Mr. F. Lee, of Hinckley, has consented to be nominated for the office of Hon. Secretary to the Commercial Section.

There was a general discussion on the report, which was unanimously adopted.

Mr. William Collen, the New President of the Institution of Civil Engineers of Ireland, in his Inaugural Address at the Institution Rooms, Dawson Street, Dublin, on Wednesday evening last, pointed out that tar, which until recently was a residual of little worth in gas-works, was now valuable for road purposes; and he emphasized the fact that the manufacture of gas was increasing year by year, notwithstanding the encroachment of the electric light.

THE NATIONAL GAS EXHIBITION.

Views of the Special Correspondents of the "American Gaslight Journal."

The issue of the "American Gaslight Journal" for Oct 27 contained descriptive accounts of the National Gas Exhibition supplied by special correspondents. Readers may remember that for many years Mr. Norton H. Humphrys has supplied our contemporary with a periodical letter reviewing gas matters on this side of the Atlantic; but he felt that he could not do justice to the exhibition as a portion of his usual communication. He was accordingly instructed to deal with the matter to the extent it required. He, however, could only give a broad and general view of the exhibition, referring readers to our own columns and elsewhere for details of the Shepherd's Bush display.

Mr. Humphrys begins by saying that an account of the impressions received during a visit to the exhibition would not be complete without some preliminary survey of the conditions which rendered such an important auxiliary to the gas industry a practical possibility; and his remarks are as follows:

It is only within the last few years that the directors of gas undertakings have risen to a realization of their responsibilities; and it is something more than a mere coincidence that the period of this awakening has been contemporary with the presidential address delivered to the Institution of Gas Engineers in 1910 by Mr. James W. Helps, with the appointment of Sir Corbet Woodall as Chairman of the Gaslight and Coke Company, followed by the selection of Mr. F. W. Goodenough as the Controller of Sales to the same undertaking, and with the formation of the British Commercial Gas Association. Formerly the directors considered themselves superior to such vulgar considerations as advertising and pushing sales. They confined their operations to the financial control of the expenditure in the interests of the shareholders, raising capital, superintending purchases, and paying dividends. Anything in the way of controlling sales was considered part of the duties of the executive staff, though sometimes the chairman, in the course of his annual address to the shareholders, did not hesitate to allude to the steady increase and growth of the business in a tone that suggested push and enterprise on the part of the board. But the manager and his staff knew well that anything beyond the normal expansion of 3 or 4 per cent. in the year would not be encouraged. Frequent extensions of capital outlay were regarded as a thing to be avoided, and a too progressive manager was rather objected to. As a natural result, the department now known as the commercial end was entirely neglected. At meetings of gas managers it roused very little interest, and was treated as quite an insignificant part of the duties. Many knew that a comprehensive advertising and canvassing scheme, if submitted to the board, would not be accepted. But to-day we find the directors strongly interested in commercial push and methods of salesmanship.

Without this change there could have been no Commercial Gas Association worth the name; and without this Association there would have been no exhibition. It is true that there have been national exhibitions—in 1881 and in 1904; that for some years past the District Associations have been running Commercial Sections; and that much has been done in the way of local exhibitions and demonstrations. But nothing extending so far or so wide as the National Gas Exhibition of 1913 has been practicable. At this point we must not overlook the Society of British Gas Industries, which has attained a vigorous and influential existence within a short time. So that, whenever united effort is required, the Institution of Gas Engineers, the British Commercial Gas Association, and the Society of British Gas Industries can join hand-in-hand; and the National Gas Exhibition is a happy example of such united effort. The best afforded by each Association combined to form a strong Executive Committee; and it is this welding together of the gas-works manager, the controller of sales, and the makers of apparatus that goes to make the venture in the fullest sense of the word a new departure. Each of these departments has had some special experience, from different points of view, in the way of attracting, educating, and serving the public demand. . . . One department will not be overdone and another neglected. The aim and object are to lay before the public, by demonstration, by pictures, by spoken and written word, the facts as to the position of the gas industry, and the service it is capable of affording to all branches of the community at the end of the first century of its existence.

Mr. Humphrys gives a few statistics in regard to the gas industry in the British Islands; and he then proceeds to refer to the opening of the exhibition by the late Lord Mayor, and to the cookery demonstrations, lectures, and conferences which were such important adjuncts to it. He furnishes particulars of the nature and arrangement of the exhibits in the seven large halls, and calls attention to what he characterizes as a "new feature"—*i.e.*, the notification given that visitors would not be expected or solicited to purchase articles shown. Mr. Humphrys remarks on this point that "there are reasons why a no-pressing-to-purchase clause should be adopted, such as proving that the show is something more than a shop. But the prospect of being invited to buy does not act as a deterrent to visitors, while it certainly serves to keep the attendants alive." Accompanying Mr. Humphrys' account of the exhibition is a reproduction of the large poster inviting the public to go to it.

The other special correspondent of our contemporary characterizes the exhibition as certainly and distinctly the best trade exhibition ever held in England. He says: "So far as one can see, it appears to be perfect in design, completeness, and propagandist value. About all that gas can do is shown to the thousands of visitors who throng through its turnstiles every day; and the lessons of the exhibits are driven home by daily free lectures and conferences, conducted by experts in the history, manufacture, and application of gas." The writer then deals with the various exhibits, concluding with that of the Sulphate of Ammonia Committee, which he says was a particularly good one. He then remarks:

In going through this magnificent display of the gas interests, one wonders what William Murdoch, the first man in England to light his house with gas, would have thought of this enormous amplification of the tiny acorn he planted. There are many relics of Murdoch here. There are accounts, letters, and note-books in his own handwriting, together with early drawings and diagrams. Among other documents shown are copies of early English newspapers of a century or so ago, which contained the announcement of the flotation of the first gas companies, and also of the formation of public companies to prevent them securing charters of incorporation. Other views of the early antipathy to gas are indicated in a collection of comic coloured cartoons, showing people being blown to pieces or poisoned by accidents occurring in connection with the new illumination. In strong contrast to all this, the exhibition itself stands pre-eminently. The authorities conducting this display have demonstrated the enormous advances in the utilization of gas by erecting a variety of living-rooms, bed-rooms, bath-rooms, kitchens, pantries, hospital wards, laboratories, and hotel kitchens fitted with gas appliances of the most approved character. . . . From all this, gas is emerging as the greatest of modern domestic and industrial devices as a light, heat, and power producer.

AMERICAN GAS INSTITUTE MEETING.

Extracts from the Presidential Address of Mr. Walter R. Addicks.

In addressing the members of the American Gas Institute on the occasion of the eighth annual meeting, some account of which has been given in preceding issues of the "JOURNAL," the President (Mr. Walter R. Addicks) made the following remarks.

The most important condition facing the gas industry to-day is the increasing cost of materials and supplies, including materials for enriching. In many States the present quality provisions were enacted to compel the use of a high candle power, which, in the absence of fuel appliances, the incandescent mantle, and the introduction of electric light, was advantageous. Conditions have radically changed; for whereas gas was formerly used exclusively for illumination, to-day it is being restricted for illumination irrespective of its economy or suitability—many architects unwisely neglecting to even pipe large buildings for gas. We should combat this tendency, and see to it that all buildings are at least piped for gas, so that future lighting, heating, and power development may be taken advantage of. The statement has been made that 90 per cent. of the gas produced is used for fuel; and taking into account the fact that the use of the incandescent mantle necessitates a fuel burner, it is probable that this will be borne out by careful investigation. It is necessary for good service that the fuel business shall be served with a gas that is not so loaded with illuminants that the burner adjustment must be very delicate to avoid carbonization of burners and mantles and of utensils. The economic loss to the consumer through a defective bunsen adjustment is very great; while at the same time the gas company are compelled to seek expensive, as well as scarce, materials for enrichment, in order to maintain a standard that tends to produce this undesirable condition. I am convinced that a candle power standard measurement of quality has outlived its usefulness, and should be replaced by a calorific standard. Your Committee on Calorimetry has directed your attention to the work of the Joint Committee on Calorimetry of the Public Service Commission and Gas Corporations in the Second Public Service District of New York State.* You would all do well to read the report from cover to cover.

It follows naturally that there should be increased interest in the manufacture of unenriched coal and coke-oven gas. The selection of type being of importance, and each type not necessarily invariably suitable to all conditions, it is fortunate that there exist large installations of all types in America, save perhaps of vertical retorts, and it is understood that during the coming year this want will be filled.

It will be remembered, in passing, that the selection of the type of gas to be supplied must be made with full consideration of the depreciation of present existing apparatus, or the facing of the problem of duplicate plants devoted to public use. Such duplication is desirable and wise in many aspects of the commercial demands of the gas business. Increasing cost of gas coal may be retarded by a possible selection from much larger supply sources, provided the legal requirements as to quality are made so that such increased sources of supply are available.

The membership has shown a healthy growth during the year, thanks to the efforts made, which, however, took on no phase of undue acceleration likely to produce results not of lasting benefit to the membership list.

A Committee appointed by your authority conferred with the Bureau of Standards, at Washington, on points arising from their consideration of gas questions; and it is hoped the views of men experienced in their profession proved of value to the Bureau. Theory and practice seem sometimes at variance. But time only is needed to balance all views; and men seeking the right may

* See "JOURNAL," Vol. CXXI., pp., 399, 459, 548, 826.

safely have abiding faith in a satisfactory outcome with justice to all.

The British Institution of Gas Engineers celebrated their semi-centennial in London in June of this year. The American Institute was represented by several members in person, and a paper was presented by one of our ablest men, who is likewise a Past-President of the Institute.

A careful consideration of the needs of your organization leads to the conclusion that further subdivision of the work of Committees is desirable. Related subjects might well be placed under several distinct Committee delineations. Is it not logical to have Committees organized somewhat as follows?

Technical Committee.—Manufacture and all subjects not assigned specifically to other Committees.

Public Relations Committee.—Including rate schedules, accounting, legal department, and insurance.

Gas Distribution Committee.—All subjects, from the works to the appliances.

Commercial Committee.—Including all matters relating to sale of gas and appliances therefor.

Residuals Committee.—Including purchasing of supplies and selling residual products, as well as physical and chemical questions relating thereto.

Committee on Arrangements and Transportation.—For annual meetings.

Each Committee should not only have a Chairman, but a Secretary. The Chairmen of these Committees should have regular conferences on their respective work, at which time the Chairman of the Technical Committee should preside.

MODERN BYE-PRODUCT COKING.

A joint meeting of the Midland Section of the Junior Institution of Engineers and the Birmingham Scientific Institute was held on Wednesday last, in the Midland Institute, Birmingham, when Mr. G. Stanley Cooper delivered a lecture (illustrated by lantern slides) on "Modern Bye-Product Coking," and made special reference to the installation of Koppers chamber-ovens at the Saltley Gas-Works, Birmingham. After dealing with the general principles of coke-oven construction, Mr. Cooper gave a detailed description of the type of oven adopted at Saltley, and explained how it could be operated to produce either metallurgical coke or a softer coke somewhat resembling gas coke, suitable for ordinary domestic consumption.

With regard to the recovery of the bye-products contained in the coal, the lecturer pointed out that practically no progress had been made on gas-works since the introduction of bye-product recovery. On coke-oven plants, on the other hand—though the coking industry was a comparatively new one—great progress had been made, and newer and better methods had been adopted. This referred specially to the method of recovering the ammonia from the gas, now known as the direct-recovery process. The Koppers direct-recovery process alone dealt with the gas from more than 25 million tons of coal per annum—more gas, in fact, than was made at the whole of the gas-works in the British Isles; and yet it was said by many gas engineers that the process was not sufficiently developed to warrant its adoption on gas-works. In every single instance where the process had been adopted on coke-oven plants, it had proved to be successful; and he saw no reason whatever why it should not be equally successful on gas-works. He referred to the fact that at the new gas-works at Buda-Pesth the direct-recovery process was being installed, and said no doubt its operation would be watched with interest by all gas engineers. It was generally recognized that the Birmingham Corporation were one of the most progressive in the country, as far as gas was concerned; and he hoped they would live up to their reputation, and be the first large town in the country to adopt the new process on their gas-works. Mr. Cooper then explained the different methods adopted, and the machinery employed, for handling the coke, and concluded his lecture by an explanation of the process of recovering benzol from coke-oven gas.

Mr. Jeavons, in the discussion which followed, said he did not quite see the object of employing a divided regenerator in the gas-oven, whereas an undivided regenerator was used in the coke-oven.

Mr. Pinnock remarked that the lecturer had said the regenerative system was the only satisfactory method of heating the air prior to combustion. He would like to know what was the objection to the ordinary recuperative system, where hot waste gas and air went in counter-current. Further with regard to the recovery of the bye-products, in the Koppers process the gas was first cooled to extract the tar, and then the ammonia was recovered; the gas being first re-heated. In the Mond recovery system the ammonia was first recovered from the hot gas, and then the tar was removed. Could not this method be followed out more economically and with the same result as the Koppers process?

Mr. E. W. Smith remarked that he had given much attention to the subject, as he had had something to do with the plant at Saltley. Mr. Cooper had said that it was not known exactly what constituted the coking property of coal. He (Mr. Smith) had taken great interest in recent experiments by Dr. Wheeler, with regard to the action of various coals on photographic plates. The resinous constituents of the coal had a very marked effect on the plate. In the case of a non-coking coal, the image obtained seemed to suggest that these constituents were thoroughly disseminated throughout the whole mass. With a coking coal, however, a number of bands appeared in the image, thus indicating a different kind of distribution.

Mr. Whitehouse asked in what way the composition of coke-oven gas differed from that of ordinary town gas.

Mr. Allcut, speaking with reference to the use of surplus gas in gas-engines, suggested that the large gas-engines in Germany were operated on blast-furnace gas, and not on coke-oven gas. If the latter was used, much trouble was experienced, and the running of the engine was not satisfactory.

Mr. Cooper, in his reply to the discussion, said the divided regenerator of the gas-oven served several purposes. Principally, it secured an even distribution of air or gas into each of the two sets of vertical flues fed from it. In the recuperative system of heating the air, waste gas and air were on opposite sides of a wall, and the heat had to be transmitted through the wall. If the wall was thin, there was good conduction of the heat from the gas to the air; but there was also great liability to leakage, and consequent contamination of the air with foul gas. If, on the other hand, the wall was thick, there would be no leakage, but conductivity would suffer. In the regenerative system, the air came into direct contact with the hot brickwork. With regard to the extraction of the bye-products, treating Mond gas was quite a different proposition from treating coal gas. The latter contained much more tar, and this would be precipitated were any attempt made to recover the ammonia prior to the extraction of the tar. With reference to Dr. Wheeler's photographic experiments, Mr. Cooper explained how these were performed. He had repeated Dr. Wheeler's experiments in a slightly modified way, and had formed the same conclusion as expressed by Mr. Smith. He had, however, come across an apparent contradiction, as with anthracite—which was a non-coking coal—he had obtained an image more similar to those of coking coals than to those of other non-coking coals. He was, however, repeating these experiments. The composition of coke-oven gas was practically identical with that of town gas. It usually contained rather more nitrogen, as the quality of the gas was of little account to most coke-oven operators, and rigid precautions to exclude air were not taken. It was not correct to say that large gas-engines were only operated on blast-furnace gas. Many were in operation in Germany using coke-oven gas, and were highly successful. Several of from 800 to 1200 H.P. were also successfully working in this country.

Professor Gisbert Kapp (who occupied the chair) moved a vote of thanks to Mr. Cooper for his lecture.

BETTER EXTRACTION OF GAS FROM COAL.

In his Inaugural Address to the Yorkshire Local Section of the Institution of Electrical Engineers, the Chairman (Mr. W. B. Woodhouse), last Thursday evening, spoke on the subject of the better extraction and distribution of the properties of coal.

Mr. Woodhouse described the present use of coal domestically, and in regard to steam-boilers, as conspicuously inefficient. The carbonization of coal as carried on by gas-works was, he said, of course, greatly in advance of the burning which accounted for a large part of the coal consumed; but the gas engineer's primary object was to produce gas, and, while the maximum yield of gas was obtained, the process of distillation did not make the best possible use of the coal. The evolution of the bye-product oven had resulted in a very efficient use of the raw material. Whatever process was adopted in the future for extracting the valuable products of coal to their utmost, could only be carried on economically on a large scale. One of the essentials for the attainment of this object was the co-operation of the various undertakings of lighting and power which involved the use of coal; and the first example in Yorkshire of such co-operation had recently been set to work at the Old Silkstone Collieries ovens (Barnsley), where the surplus gas from the coke-ovens produced continuously some 2000 kilowatts of power, which was used for supply by the Yorkshire Electric Power Company. With a recognition of the folly of burning coal in dwelling-houses, the alternative of burning coke or smokeless fuel must increase; but in regard to convenience and cleanliness, the use of gas presented advantages over that of coke. While in cleanliness and healthiness and the reduction of domestic labour, electricity was superior as a means of distribution, in regard to cost one must recognize that the production of coke or semi-coke would in the future be enormously increased; and unless the demand increased in proportion its price would fall to such a point that in many cases its cheapness would outweigh any advantages of its competitors. The best results in general would be obtained by some compromise of all interests. They should let private enterprise continue to develop improved methods, while, if the municipalities desired to exercise some control over the development, they should assist in the finance.

Sir Joseph Swan, F.R.S., the inventor of the incandescent electric light bearing his name, recently celebrated his eighty-fifth birthday, at his residence on the Surrey hills. He still takes the deepest interest in scientific progress.

TAR FOR ROADS.

By C. H. Webb, M.Sc., A.M.Inst.C.E.

[A Paper read before the Midland Gas Association, Nov. 6.]

This short paper aims at giving a description of the plant at the Stourbridge Gas-Works for preparing tar for roads, and also answers to the various questions which would be asked by an engineer when considering the advisability of installing a plant for this purpose at his own works.

Less than two years ago, a small Wilton tar dehydrating plant was erected, guaranteed capable of dealing with 100 gallons of crude tar per hour. This figure can be considerably exceeded unless the percentage of water in the tar is above the normal. The special feature which led to the selection of this particular apparatus is that it is on the enclosed system; the tar being heated in a slow continuous stream, instead of in bulk, as in the open system. By this means excessive frothing is prevented, safety is obtained, and the constancy of the finished product is more readily assured—the last being an important point when working to the Road Board specification, which can be satisfied more or less closely, according to the kind of coal used and the temperature of carbonization. In most cases, no trouble need be expected in this direction; but it would probably be wise, before deciding to instal a plant, to send a few tons of the crude tar produced to be put through a dehydrating plant at some other gas-works, and analyze the resulting product.

The Road Board specification allows a maximum of 10 per cent. of carburetted water-gas tar in the crude article, which corresponds approximately with a proportion of 30 per cent. of carburetted water-gas in the mixed gas, varying according to the oil used per 1000 cubic feet. If the phenol or ammonia content should be found high, these can be reduced by a raising of the working temperature. This will naturally increase the proportion of free carbon, although this is not so important, and the Road Board have recently raised their limit for this constituent to 20 per cent. A liming attachment can be added to the plant as a last resort, but this means that more attention will be required in working.

The principle of this dehydrating process is that the tar is heated—usually to about 170° or 180° C.—when under pressure of about 30 lbs. per square inch, and then released into a chamber, when the water and light oils, being at a temperature higher than their respective boiling points, are evaporated, and leave the dehydrated and acid-free tar.

The crude tar is supplied in our case from the overhead land-sale tank by gravity into the suction or feed tank, from which it is continuously pumped through the pre-heater or economizer, the coils of which are surrounded by hot dehydrated tar. After absorbing some heat in this, the crude tar passes on to the still, which is a brick structure containing about twelve laps of coiled piping, heated by a small breeze furnace with forced draught. As it passes through the coil, the crude tar is brought gradually to the desired temperature, and, on leaving, passes a relief valve into the vapour box, where for the first time a free space is provided, and the pressure is suddenly reduced. The water and the light oils are vaporized, and leave the tar, which flows away through the economizer—where it parts with some of its heat to the incoming crude tar—on to the store tank.

From the top of the vapour box, the vapours are led through a coiled condenser surrounded by cold water, and thence to a receiver, where the weak ammoniacal liquor and light oil separate by gravity. The liquor is run at intervals from the bottom of the receiver to the works well, while the light oil goes continuously from the top of the receiver through a sealed overflow into a store tank, from which, in our case, it is run into railway tank cars by gravity. As the vapours contain a varying amount of sulphuretted hydrogen, the receiver is water-sealed and connected with a small lime purifier.

It is necessary to obtain a certificate of registration under the Alkali Works Regulation Act, 1906, and the plant is regularly examined by the Government Inspector. If a certificate is held for the manufacture of sulphate of ammonia, it will be included in this, with no extra stamp duty.

The plant is simple, easily worked, and gives little trouble, and the repairs are light—not more than £5 up to date. But the relining of the furnace is now necessary, after working-up 1500 tons of tar—say another £5. It is run by one man, whose duties are to keep the plant supplied with tar, and the temperature and pressure constant, which is done by regulating the firing and the speed of pumping through the plant. There is usually enough spare time to allow of a number of barrels being filled in addition. There is also the extra labour required for filling the remainder of the barrels, and for the dispatching, which will be referred to again.

The plant is under the part-time supervision of a technical assistant, who makes the necessary tests, records the results, and looks after the orders, dispatching, &c. If worked one 12-hour shift per day, the effective time is about 10 hours; one hour being required for getting-up, and one hour for letting-down. In this time 1000 gallons, or 5 tons, are treated. If the plant is run continuously day and night, the effective time per shift is increased to 12 hours, and the quantity treated to 6 tons. The fuel used averages about 40 lbs. of coke breeze per hour. Steam for the furnace and pumping, and water for cooling, are very small items.

A duplicate pump and relief valve have been connected-up, to guard against breakdown. A Bristol recording thermometer has been fixed, which can be read from ground level, and is of great assistance in reducing fluctuations of temperature. If the ordinary indicating thermometer supplied with the plant is used (fixed at a height of 10 feet), the attendant has frequently to go up a ladder to read it.

The storage arrangements are: An underground well, 65 feet in diameter, capacity 1500 tons, for crude tar. One egg-ended boiler, capacity 15 tons, for light oil; another is to be added before next season. Two egg-ended boilers, each of 15 tons capacity, and a square tank, 60 tons capacity, for dehydrated tar.

The ground space for the plant itself, as supplied by the makers, is small, being only about 30 by 15 feet. In addition, there is the room for the tanks, &c.—in our case about 30 feet by 30 feet. To economize space, arrangements have been made for carrying two more egg-ended boilers on supports above the three existing ones. The total cost of the outfit, including foundations, plant, connecting-up, and three old boilers, is under £350. The underground well and square tank were in use previously.

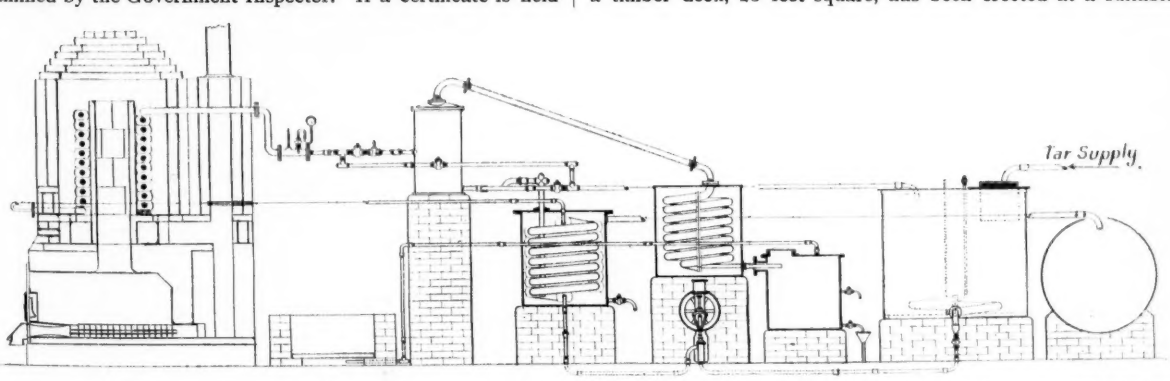
It is essential that the tanks should be fitted with a range of piping for steam-heating the tar in cold weather when packing in barrels, otherwise it will not run freely. In hot weather, or when freshly-made tar has to be barrelled, cold water is run through the piping, as, if packed too hot, the barrels will be injured.

The storage for crude tar is the most important point to consider; for, as the tar is required chiefly in four months (April, May, June, and July), the maximum quantity which can be treated in that time is the amount in store at the beginning *plus* the amount produced in these months.

As our crude-tar tank holds more than a year's make, we are able to deal with all our tar. This is a very fortunate position to be in, and, I believe, rather exceptional. If the demand for tar is less than the output of the plant (84 tons per week), then the storage for dehydrated tar need only be small; but if greater than this rate (in our case it varies from 100 to 150 tons per week), then storage must be provided for heavy rushes of work on the roads in fine weather.

The packing in barrels for transport is the most troublesome and costly part of the business; a considerable amount of labour being required. The barrels need constant repairs, as they must be kept perfectly sound, especially when sent by rail. The question of using steel barrels or drums should be very seriously considered; for although the initial outlay will be much greater, I think this would be repaid in a few years by the saving in repairs, as compared with wood barrels. In any case, the quantity in a package should not exceed 50 gallons, as I am informed that this is the largest size which can be conveniently dealt with by the tar-painting machines at present in use.

To facilitate loading on to the motor waggons and railway drays, a timber deck, 20 feet square, has been erected at a suitable



WILTON'S PATENT TAR DEHYDRATION PLANT.

height. As the process of rolling loaded barrels up an incline on to this deck is very laborious, it is proposed before next season to provide either a small lift to take up the barrels by power or a much larger deck on which the barrels can be filled. As mentioned previously, tar must be only at a very moderate temperature when packed, or else the wooden barrels will leak. This is another point in favour of steel barrels.

The minimum annual quantity of tar for which a plant may be installed to pay standing charges is probably 100 to 150 tons. In considering the possible local demand, it should be borne in mind that, in addition to the tar for painting roads, a satisfactory article for tar macadam work can be easily produced (by making a small addition to the plant), and that this tar is used at another season of the year. In a town of the size of Stourbridge (2000 acres, 20,000 population), the quantity of tar taken for this purpose is from 100 to 150 tons annually, according to road mileage.

I understand that surveyors are desirous of undertaking the work of macadam mixing themselves, as, apart from the saving in the cost of the tarred stone, employment is found in wet weather for the roadmen. A saving of 20 per cent. can be made, after paying interest and sinking fund on the outfit, if the annual quantity of stone tarred is not less than 2000 tons. The tar macadam plant at the Stourbridge town yard cost less than £350 complete with shed. The results obtained by using our special tar with this plant are very satisfactory.

A table is given showing tests made by an independent Analyst, also the Road Board limits for the various constituents, and another table showing the results of twenty-four hours' continuous working of the plant. From this table, an engineer can compare the value of his crude tar with that of the proportions of the three products obtained; and after deducting the working expenses, which may be taken as being about 5s. maximum per ton of crude tar, the profit can be easily ascertained.

A small plant is now on the market for obtaining benzol, for sale as motor spirit, from the light oil, and the advisability of installing it is now under consideration at Stourbridge. If it is adopted, I shall be pleased to give to the Association some particulars concerning it at a future date.

Twenty Four Hours' Test of Tar Plant, June 17-18, 1913.

All specific gravity tests made at 21·5° C.

—	Crude Tar.	Dehydrated Tar.	Light Oils.	Ammonia Water.
Gallons per 24 hours . . .	—	3148	319	67
Specific gravity	1·156	1·185	·945	1·013
Percentage by volume (approximately)	100	89·1	9·0	1 9
Weight per 24 hours . . .	18·3 tons	16·7 tons	3014 lbs.	679 lbs.
Percentage by weight . . .	100	91	7 4	1·6

—	Specific Gravity at 150° C.	Water.	Ammonia.	Phenol.	Distillation.		Free Carbon.
					Below 170° C.	170° to 270° C.	
May 7th, 1912—							
Working temperature, 165–170° C.	1·179	·05 per cent.	Not tested, water being so small	2·3 grains	·9 per cent.	24·2 per cent.	15·63 per cent.
April 12th, 1913—							
Working temperature, 175–180° C.	1·210	Slight trace	Ditto.	·065 grains	·2 ,,	19·6 ,,	16 06 ,,
Road Board	1·16 to 1·22	1 per cent. maximum	5 grains per gallon of the tar	5 grains per gallon of wash water 20—1	1 per cent. maximum	16 per cent. to 26 per cent.	20 per cent. maximum

DISCUSSION.

The PRESIDENT (Mr. W. S. Morland) said there was no doubt that the use of tar for roads had been the salvation of the tar industry; and he believed it would come into more extended application for the purpose. Its use in this way was only yet in its infancy in some counties.

Mr. GEORGE HELPS (Nuneaton) said he was not in the happy position of Mr. Webb, because he had had no experience of the plant he had brought to the notice of members that day. But he had a remark or two to make in connection with the use of tar for roads which possibly might be of interest. Some three or four years ago, the Surveyor of Nuneaton asked the Gas Company to supply him with prepared tar; and he was ready to enter into a contract for it. He (Mr. Helps) obtained instructions to set to work; but before doing so, being a little cautious, he obtained for the Surveyor some prepared tar from other places—probably 100 tons. The tar was tried; and the Surveyor did not like it. Then he tried some ordinary crude tar; and he had since taken practically all the Company's output. Another point in connection with this was that when, a year or two ago, the "Municipal Engineers" held their meeting in Nuneaton, a discussion took place on this very question. Probably some twenty to thirty men spoke on the matter as to whether crude tar or prepared tar was better for road purposes. So far as he could gather from what he heard, opinion was much divided, with a leaning in favour, he thought, of crude tar. If crude tar were practically freed from water, it was of great importance. Perhaps there was another matter of more importance—that was atmospheric temperature. The difference made when tar (crude or prepared) was applied to roads by the prevailing conditions was considerable—particularly as to whether the road was wet and cold, or dry and warm, when it was treated.

Mr. W. G. S. CRANMER (Willenhall) said he was well acquainted with a town where nothing but crude tar had been used, for many years now, for this purpose; and anyone visiting the town would say the roads were as good there as, if not better than, in most places. Certainly the roads were not subjected to any very heavy traffic. In his own case, they supplied what they called prepared tar; and when they first commenced to do this, they sent some to a neighbouring Council, who were so satisfied with the material that the manager (he was present at the meeting) put down a somewhat similar arrangement to his (Mr. Cranmer's) own, to supply the surveyor of the Council with tar of the same nature. He thought that a good deal, as to whether or not the tar was satisfactory, depended on the method, or the machine, by which it was applied. He had noticed in many places, different ways of applying tar to the roads. It one case it was boiled in a pot, then spread on the ground, and brushed in with bass brooms. He had also seen it applied by means of a large square tank, and spread at the back with some sacking to prevent splashing. The sacking dragging on the surface also tended to spread the tar. The machine by means of which the tar was applied in his case, he thought, would make use of crude tar with quite as good results as prepared tar. The tar was heated in a boiler, on wheels, and drawn by a horse. At the back of the tank was a pump, which a man worked and forced the tar out under pressure through a circular spreader. The tar came out in a fine flat spray; and coming out at a high temperature, the light oils and water were evaporated and passed away as vapour—only the actual tarry matter coming in contact with the road. Excellent results were obtained with the machine, though the tar did not comply with the Road Board's specification. It only contained a very small quantity of water; but in other respects it was tar which would not conform with the Board's specification.

Mr. H. E. COPP (West Bromwich) asked the author what he considered would be a normal percentage of water in tar. As to the pressure under which the tar was heated—viz., 30 lbs. per square inch—was that an arbitrary pressure, and would some other pressure do? The reason he asked this question was that, in estimating water in tar for laboratory purposes, the only way he knew of for doing this satisfactorily was by distilling the tar under a vacuum; and, watching one's opportunity, have a tap to admit air directly the tar began to froth. He could quite conceive it could be done in the way that Mr. Webb did it in his plant. As to whether the plant would pay on ordinary works, turned entirely on the question of how much tar could be stored. Mr. Webb was happily situated; as, when one had large storage capacity, it seemed to him (Mr. Copp) the financial aspect of the tar proposition became quite a different matter. He should like to ask Mr. Webb whether he sold his light oils or redistilled them. He had tried this himself; and he had produced quite a respectable looking benzol or motor spirit. But all was not gold that glittered; and there was a glutinous substance in the liquid which was fatal to motor-cars.

Mr. A. T. HARRIS (Market Harborough) warmly congratulated the author on having been one of the pioneers in dehydrating his tar. He (Mr. Harris) was strongly of opinion that a great deal in connection with success or otherwise depended upon the condition of the tar as sent out. His Council took 120 tons out of a make of 280 tons; and this was used on the roads and footpaths. Until this year, the County Council refused to make an allowance to his Council for money expended on the improvement of the roads when crude tar was used. The Council then decided to try another mile of road with prepared tar, and according to the specification, and under the supervision, of the County Council Surveyor. The work was carried out by the Local Authority; and several members of the Council had since stated that they considered, when the work was done by the local surveyor with crude tar, the result was equal to that obtained with prepared tar. It was found that there was quite as much "picking-up" with the prepared tar as with the crude tar. This being so, the County Council had agreed to make the local authority an allowance for road-making with crude tar from the gas-works. He (Mr. Harris) was of opinion that a great deal depended upon the method of storing the tar. They made a rule for all the tar used locally to be pumped into overhead tanks, and left there as long as possible, so that any water could rise, and go away simply by the settlement of the tar. He found if they worked the tar from the well, and it had been more or less churned, they did not get the same results on the roads and foot-paths as they did after storing the tar for a considerable period. It was therefore, to his mind, more or less a question of the condition of the tar as sent from the works; and if a greater measure of precaution were taken to get the tar stored, and not disturbed, for a long period before being

sold to the local authorities, there would not be much, if any, objection made to the tar in the crude form.

Mr. COPP said he had been referring to the total water in suspension.

Mr. W. W. TOWNSEND (Hereford) said it seemed to him they were going back to the state of affairs that existed some years ago. When a commencement was made with the use of tar for road purposes, it was with crude tar; and the surveyors found that on the whole it did not do. The Road Board's specification was then drawn up; and it appeared to him that it was useless for them as sellers to say what the buyers should have. They must comply with what the buyers wanted. The members were indebted to Mr. Webb for showing them how to deal with this matter in a proper manner. He believed that Mr. Webb sold more tar for this purpose than the whole of those present in the room put together; and if they were going into this business in a wholesale way, it would pay them to put down proper plant for doing it thoroughly. He might say that he had been preparing tar for the last six years simply by heating it up with steam; and the tar had been successfully used on the roads both for tar painting and making tar macadam. The tar was not a crude tar; and he did not sell it as such. It was a prepared tar. He had an analysis of it made by Mr. W. J. Atkinson Butterfield. He reported that the specific gravity was 1·225. The water was 0·5 per cent., which was under the Road Board's maximum. The ammonia was 15 grains per gallon, which was above the Road Board's minimum. The phenol was 1·5 grains, which was a good deal less than the Board's maximum. The distillation below 170° C. was 0·7 per cent.; and between 170° to 270° C., 20·3 per cent. In all these respects the results were within the Board's specification, except the ammonia, which was slightly above the prescribed amount. The free carbon in the tar was 22·6 per cent., which was 2·6 per cent. more than the specified maximum. It appeared to him that it was of no use a gas engineer laying down plant costing £200 to £300 for preparing tar; and then for him to discover that, his carbonizing plant being of a particular character, he was unable to get tar of the proper composition. Wilton's plant would not alter the free carbon, nor the distillation. Mr. Butterfield, at the end of his analysis, said the tar was suitable in every respect for use on the road, except that it would be an advantage to boil it for a few minutes before applying it, in order to remove the surplus ammonia. The tar was found to be satisfactory in practice; and the analysis showed that it was satisfactory. They had attained this result at an expenditure of about £20 at the outside. This year he was putting down a storage tank, which would enable them to deal at Hereford with more than 300 tons of the winter's make; and next year they were going in for the sale of tar for making tar macadam. He should like to ask Mr. Webb how the prepared tar he sold was heated before being applied to the roads, because a good deal turned on this. If tar as sold was a crude tar, the question they had to consider was whether it could be boiled on the roads in order to make it suitable for use there. If the tar contained a good deal of water, it could not be boiled on the road without trouble. If they took out enough of the light oils to enable the surveyor to finish the distillation, he was able to make a proper product on the spot.

Mr. W. LANGFORD (Longton) congratulated Mr. Webb on the lucid paper he had put before the members. They were all interested in the sale of tar; and some of them thought they did not participate sufficiently in the extensive use of tar for road-spraying purposes. He had a conversation on this matter with their road surveyor some two or three years ago, when the surveyor was smitten with the idea of jet-spraying the roads. He said the crude tar he (Mr. Langford) sent him was not quite right. Afterwards he got some boilers and furnaces, and now he had got just what he wanted in the way of tar. They had an arrangement to take back all the ammoniacal liquor that came off the tar, and to give back to the surveyor a *quid pro quo* in the shape of tar. Something like 300 to 400 tons of tar were in his case used for road purposes. This was an advantage to the public and to the gas undertaking. The roads were sprayed with tar, and than coated with a fine gravel or grog, and left to dry. There were no complaints; and both roadways and footways were materially improved. Best of all, the authorities were much pleased with the arrangement. The gas undertaking was getting a better price for its tar; and it had not been at the expense of providing the plant described by Mr. Webb.

Mr. J. S. CRANMER (Stratford-on-Avon) remarked that the question of £ *s. d.* had not yet been touched upon; and he should like to know what benefit they were likely to receive in the enhanced value of the prepared tar. Mr. Webb told them that it cost 5s. per ton to dehydrate the tar. Taking as a basis a value of 30s. a ton, the 5s. brought the price down to 25s. What price did Mr. Webb get for the dehydrated tar to compensate for the cost of treatment? He might say that he asked this question for the simple reason that quite recently they invited tenders at Stratford-on-Avon for their tar, and received offers. When these came before the Committee, one of the members questioned the advisability of selling the tar, and suggested they should work it up themselves. He said that they would get benzol which was worth so much, and other things were also going to be recovered. He (Mr. Cranmer) was rather taken aback, and wanted to know where he obtained all this information from. He said that he had paid a visit to a neighbouring gas-works, and obtained it there. To be met in the room with all these particulars was more than he (Mr. Cranmer) was prepared for. He was pleased to learn that this paper was going to be read that day; and he came there prepared to hear what results were obtained, and what profits were likely to be secured by the dehydrating process. But there was little information on the point. Going back to the subject of the use of crude tar as compared with dehydrated tar, at Stratford-on-Avon they had used crude tar now for the last seven or eight years for spraying and asphalting purposes; and everybody who visited the town (and some thousands did so every year) remarked on the splendid condition of the roads. The tar was simply crude tar; and the surveyor had adopted one of the latest machines for spraying it. The tar was boiled in a vessel on wheels, and it was horse drawn. The tar was boiled at the time it was sprayed; and the result was highly satisfactory. Like Mr. Webb he fortunately had a good amount of storage for tar; his capacity being about 200 tons. The result was that there was little or no water in the tar; and the surveyor was very pleased indeed with the results obtained. Therefore unless they could see some satisfactory results in £ *s. d.*, he thought they could go on selling the crude tar in preference to putting down a plant for dehydrating it.

Mr. P. H. FLETCHER (Evesham) said he should like to know what the previous speakers meant by crude tar. Was it tar just as made at the gas-works, or was it tar which had been heated in open boilers, such as were used by many surveyors? If the latter, this was not crude tar but prepared tar. There was no difficulty in boiling tar in open vessels, even if it contained a high percentage of water, providing it was closely watched in the early stages of heating, and the water skimmed off the top as fast as it rose to the surface. The tar, on being heated, quickly liberated the water combined with it, and if this was removed at once, no frothing took place. When dehydration was complete, the temperature of the tar rapidly increased to about 160° C.; and it was advisable to continue the distillation at this temperature for some time, especially if it was to be used for the manufacture of tar macadam. In his opinion, raw tar was not nearly so good as prepared tar for road purposes. It seemed somewhat strange that the authorities allowed tar to be boiled in open vessels as long as they were mounted on wheels, but, if fixed, they must be closed and connected to a purifier.

Mr. F. SHEWRING (Droitwich) said they supplied tar from his works—some prepared, and some crude. The tar was boiled at the gas-works in open vessels; and the light oil and the water content were considerably reduced. Droitwich obtained a portion of the money spent on the main roads—a portion of the money was refunded by the county; and, as Mr. Webb was well aware, the surveyor was rather particular about having good material. He had found that, by boiling his tar for eight hours, it practically complied with the conditions laid down by the road authorities. For several years, he had had an opportunity of passing over roads which had beeen treated with dehydrated tar, and roads treated with crude tar simply boiled, and he failed to see that there was any difference at all in the surfaces. Regarding the method of applying it mentioned by Mr. Cranmer—with a vessel hand-pumped under pressure, and delivering the tar to the road surface in the form of spray—he quite agreed that the boiling in that case to a certain extent drove off a portion of the water content; but he thought that the tar would have to be low in water content for it to reach the quantity allowed by the Road Board's specification.

The PRESIDENT remarked that at Gloucester they sold a good deal of their tar for road purposes. They sold it in the crude form; and it was taken away, put into a boiler as required, heated up, and while warm it was sprayed on the roads. It appeared to him to wear perfectly well all over the county. The City of Gloucester had also followed the method of boiling the tar in a one-horse vehicle, with a fire underneath it; and they used a pump to compress the tar for spraying purposes. They had now gone in for a more expeditious method. They had a steam-roller; and, having done away with the water in it, they put tar into the boiler, and heated it up. Cocks were so arranged that the tar could be run across the road. They had also had a big broom made for brushing in the tar. The little steam-roller was started running along the road; and with it they could do miles of roadway a day. They swept the dust off the roadways; and when the work was done, it was just as good as if a forced spray had been used, and the reduction of cost was very considerable.

Mr. WEBB said, before replying to the discussion, he should like to read a letter he had received from Mr. Samuel Glover. In the course of it, he said:

> I have been reading your paper; and, as I have seen your plant, was much interested in the description.
>
> If I were able to be with you to discuss the subject generally, I should commend the very valuable warning you give as to the importance of remembering that tars vary in their nature and composition if produced from various coals or from the same coals treated in various carbonizing processes, or at various temperatures.
>
> I think it ought to be clearly stated that all tars are not suitable for meeting the needs of road-making engineers after merely being treated in a dehydrating plant, nor can one correctly speak of tars being "acid-free" when they have only had such oils removed as are removed with such a plant as is useful for dehydrating purposes. Many tars might, after the first runnings had been taken off, be so very heavily laden with naphthalene as to leave the water-free tar unfit for either road-dressing or asphalte or tar macadam mixing.

In answer to the discussion, the first point with which he had to

deal appeared to be, What was crude tar? [Laughter.] As he understood it, it was the tar taken from the gas-works well, and pumped up to the tank, or into a canal boat, or railway tank-waggon for dispatch without being treated. It might have more or less water in it, according to the way it was stored and handled. As to whether satisfactory results could be obtained with crude tar, if he had not such a plant as he had described, he should be looking at the results that could be obtained with crude tar; but as he had such a plant, he did not consider the question that way, and this he thought quite justifiable. [Laughter.] But, seriously, it seemed to him a pity just to take crude tar, and heat it, and allow the light oil to go away into the atmosphere, and be wasted. They had found the light oil an important factor in the balance-sheet. Mr. Helps mentioned the different results that were obtained according to the condition of the roads. This was a very important point. What he (Mr. Webb) knew about the use of tar was not first-hand knowledge. It was simply procured by conversation with various surveyors to whom he supplied the article they required. They all agreed that the road should be dry and warm, and thoroughly well swept. Some men were keen about sweeping clean, and even finishing with a soft broom. He had been told that, if the road was warm and dry and well swept, the tar, even when supplied by gravity machines, without being under pressure, had been found to penetrate to a depth of over 1½ inches. Surveyors had picked up roads, and had found this, and had been surprised that tar would run in to such a depth without any force whatever being applied. Mr. Copp asked as to what percentage of water there should be in crude tar. The figure usually adopted in most contracts was that it should not exceed 5 per cent. This had always been so in the days when, in their own case, they made an annual contract with the distillers. The last crude tar he tested had, after being stored a length of time, 4½ per cent. of water in it. He thought the importance of having ample storage should be realized in this way: If care was taken to pump tar so as not to splash in the storage tank, a great deal of the water in combination would settle out. If they had 10 feet of tar in the well, they found in a short time they had 6 inches of ammoniacal liquor, which was pumped back to the ammonical liquor well. Mr. Copp also raised the question as to boiling on the roads. There was no objection to this, except that there was a waste of light oils. As to the pressure under which his plant was working, it was not an arbitrary pressure at all. The only thing one must see was that the pressure was such that the liquids would not boil over at the temperatures to which one heated them. One must have a good margin (they had worked as low as 20 and 25 lbs.), so that the liquids could not boil over until they had been released. Their method of dealing with the light oil was simply to store it in closed tanks, and load up a 10-ton railway tank when they had sufficient. Consideration was now being given to the question of putting in a plant which the makers guaranteed would produce a 90 per cent. benzol suitable for motor use. They had been making a benzol from the light oils, and several motor bicycles had been running on it in Stourbridge. Regarding the point raised by Mr. Harris, the chief need that had been felt for conforming with the Road Board's specification was that road surveyors had to use tar complying with the latter before they could get an allowance towards the painting of the roads. He thought this was a point that weighed with them more than any other. Mr. Townsend asked as to the attachment that he fitted for making a thicker tar. They simply led into a vapour box in the tar itself a small quantity of superheated steam. This drove off a greater percentage of the constituents, and left a thicker tar. They were able to put the specific gravity up from 1200 to 1230, or something like that, and it made a stiff tar; and the surveyors asked for the stiffest tar for macadam mixing. He agreed with Mr. Townsend that it was like ancient history talking at the present time about going back to crude tar. Crude tar was all very well at one time; and now they were dealing with dehydrated tar, it seemed more natural to treat it at the works. It appeared to be better that it should be treated in a closed vessel without any danger. Then the amount of the article taken from the gas-works was almost 10 per cent. less. They saved at least that much, or almost that much, in the carriage expenses, because taking 100 per cent. of crude tar, they had only 91 per cent available for putting on the roads after properly boiling it. Mr. Cranmer, of Stratford-on-Avon, asked a question as to the financial results. He (Mr. Webb) particularly put the financial figures in such a way that he thought anyone could obtain a balance-sheet in his own particular case. As would be clearly understood, he did not want to publish figures as to their results. He would, however, be pleased to give privately to Mr. Cranmer, or to any other member, information as to the financial results, which were found so extremely satisfactory. About the treatment of tarred roads, he quite agreed with Mr. Fletcher's remarks. He understood Mr. Shewring to say that he could get a tar which practically complied with the Road Board's specification, after boiling it for eight hours. Surely this was too long a time to be practicable in any way. In his own case, the tar was steadily pumped through the plant; and it was in the plant only about half a minute or a minute. He believed with the President, that, though good results could be obtained by a road-spraying machine under pressure, equally good results could be realized without any pumping at all. It was found that, if the tar was well heated and the road was clean, the tar did quite as well as being put on the road under pressure.

GAS SUPPLY TO OUTLYING VILLAGES.

By W. M. Valon, of Stafford.

[A Paper read before the Midland Association of Gas Engineers and Managers, Nov. 6.]

In discussing the question of supplying gas to small villages situated five or six miles away from a gas-works, one often wonders whether it is likely to be financially successful. It may, therefore, be of interest to the members of this Association to hear a record of personal experience of such work; and, although an explanation is given of how the work of laying the mains, &c., has actually been done, the object of the paper is not a technical one.

Low-Pressure Supply.

Drawing No. 1 shows, on plan, the villages joined up. In the year 1910, the village of Brocton, 4¼ miles from Stafford, applied to the Stafford Corporation for a supply of gas. This district had been allotted to Stafford fifty years previously, and, though such powers had not been exercised, the mains were already laid to Milford—a distance of 1655 yards away. Pressure charts were taken at the end of the existing main; and it was found that at no time during the twenty-four hours did the pressure drop below that at the gas-works governors. It was, therefore, decided to lay a 4-inch main from the existing system into the village and supply with ordinary low pressure.

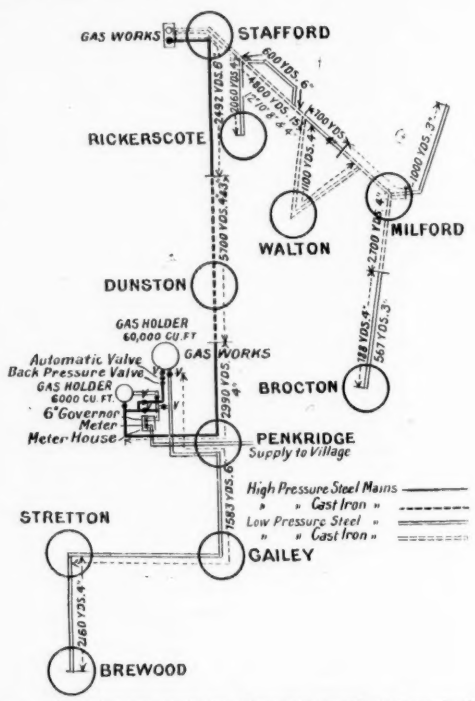


Fig. 1.—Plan Showing Outlying Districts Supplied from Stafford.

As there were at this time only ten large houses and twenty small ones in the district, it was not anticipated that the consumption of gas would at first be sufficient to pay the capital charges on the outlay. It was therefore necessary that the work should be carried out in the most economical manner. With this object in view, the cost of laying various classes of mains—such as cast iron, mild steel, &c.—was carefully estimated, and for purely financial reasons, it was decided to lay thin mild steel mains with ordinary lead joints. The pipe mains were supplied by Messrs. Stewarts and Lloyds, and were of mild steel, 4 inches and 3 inches diameter, and No. 11 gauge in thickness. They were lap-welded, coated with Dr. Angus Smith's solution on the outside only before being wrapped with hessian cloth, and then re-coated. Each pipe was from 20 to 23 feet long.

The particular form of socket joint adopted was Messrs. Stewarts and Lloyds patent inserted joint [see A on drawing No. 2]. On reference to this, it will be seen that the socket is materially strengthened by being made a little longer than usual, and the extra length turned in upon the socket so as to form a double thickness of tube round the rim—this being the point where the heaviest strain is set up while the joint is being caulked. The formation of the socket is conical, so that it prevents the jointing material from drawing. The faucet end of the tube is belled, so that when the tubes are properly put together this belled portion fits immediately into the shoulder of the socket, and, therefore, is an extra prevention of drawing.

As this was the first time the above class of main had been used at Stafford, two methods of joining the services to the main were tried—one being Stewarts and Lloyds' patent expanding nipple, and the other their patent gland connection. The expanding nipples [Aa on drawing No. 2] consist of a steel nipple, curved,

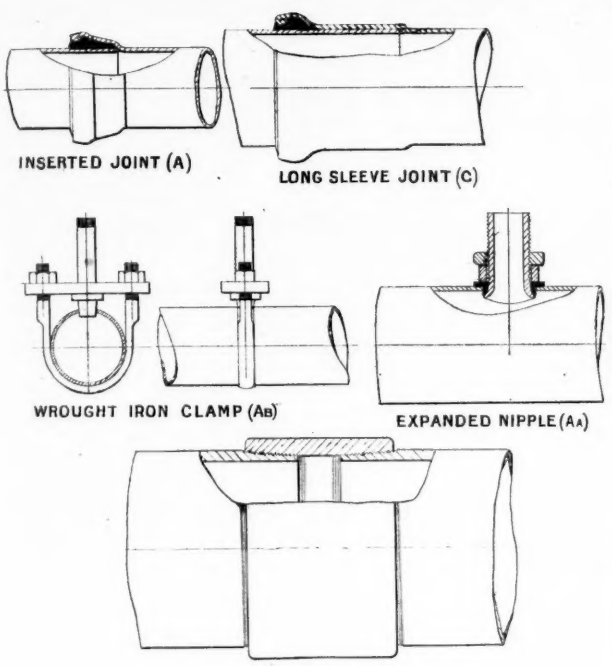


Fig. 2.—Types of Joints used.

opened, and shaped at one end to fit the main, and having a male thread upon the other to take the lock-nut and socket, as shown. The method of attachment is as follows: A hole is drilled in the main large enough to allow the special end of the nipple to slip through. The lead washer is then slipped over the nipple, followed by the distance-piece, and also the lock-nut; and the latter is screwed home. Grooves which are to be kept in line with the centre of the main are cut in the end of the nipple, and two lock-nuts are used to keep the nipple in position. It will be noticed that the special end is curved to fit the main. The patent glands (AB) are saddle-shaped. The upper side of the branch tube is screwed for the size of branch wanted, while the lower side can be either tapered for drawing tightly into the drilled hole or made parallel, in which case it is used with a lead joint washer.

The cheaper of these two methods is the expanding nipple; but from experience gained, only the saddles are now used for joining services from these thin steel mains. So that all joints could be tested as laid, an india-rubber disc was put into the main and drawn along as the work proceeded. This allows all joints to be tested with gas as soon as finished; while consumers can be supplied as soon as their services are connected, instead of waiting until the whole job is completed. The apparatus used is shown on drawing No. 3, and marked C. The total cost of laying these mains, including labour, material, and reinstatement of road surfaces, worked out at 3s. 8d. per yard for the 4-inch, and 2s. 7d. per yard for the 3-inch. As the cost of materials is now 15 per cent. dearer, the present cost of laying the mains would be increased *pro rata*. Within twelve months of the main being completed, every cottage in the district had applied for a supply of gas (mostly on the prepayment system), and six large houses were connected up. There had been nineteen cookers and eight fires, with the happy result that the profits from the sale of gas were equal to 12 per cent. on the outlay.

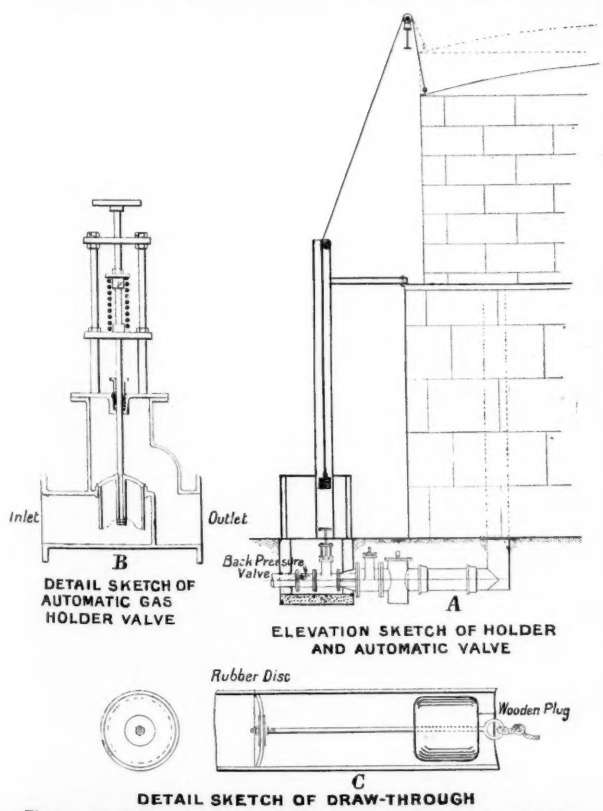


Fig. 3.—The Penkridge Gasholder and its High-Pressure Supply Fittings.

High-Pressure Supply.

In another part of our district is a village called Penkridge, about 6½ miles from Stafford, which for many years had been supplied with gas by a small local Company. Bearing in mind the experience gained at Brocton, it appeared to be a paying proposition—should the local Company be prepared to sell at a reasonable price—to buy them out and extend the Stafford mains, which were already at a village named Dunston, 2990 yards away. Negotiations were entered into, with the result that the old Company was purchased outright for the sum of £2250, including all law and other charges. The mains already laid to Dunston were made up of 833 yards of 15-inch, 100 yards of 12-inch, 616 yards of 10-inch, 800 yards of 8-inch, 600 yards of 6-inch, and 4900 yards of 4-inch and 3-inch cast-iron pipes.

As the supply at Dunston was already hardly sufficient, as regards pressure, it was impossible to supply Penkridge under ordinary low pressure from Stafford unless the mains were considerably enlarged throughout; and as the cost of doing this was entirely out of the question, small mains and high pressure were decided on. It was found that 3½ miles of the existing mains could be isolated, commencing at a point 2434 yards from the Stafford Gas-Works and finishing at Dunston, 2990 yards from Penkridge. To each end of this a steel main was joined; the Stafford end being 6 inches in diameter, and the Penkridge end 4 inches in diameter. By this means a separate main was obtained right from the gas-works to Penkridge. The 2434 yards of main at the Stafford end up to the point where it joined the old cast-iron main is 6 inches diameter, of mild steel, No. 6 gauge, $\frac{3}{16}$-inch in thickness, coated outside only with Dr. Angus Smith's solution, wrapped with hessian cloth, and recoated—each pipe being 20 to 23 feet long. The joints are screwed and socketed with a special taper thread; and so that the screwed end shall not be damaged in transit, the pipes are sent out protected with screwed ring pieces.

The mains were made and supplied by Messrs. Stewarts and Lloyds, of Birmingham, who also designed the joint [as marked B on drawing No. 2]. The services are connected by screwing direct into the main, in exactly the same manner as when using cast iron. A test certificate, showing that every pipe was tested to 500 lbs. per square inch before delivery, was supplied by the manufacturers. The 2990 yards of main from Dunston to Penkridge was 4 inches in diameter; being in all other respects exactly the same as the 6-inch. An india-rubber disc was used in laying the mains, so that gas was taken along as the work proceeded, and each joint, as made, was tested with gas under 6-inch pressure. On the work being completed, both sections of new main were tested to 10 lbs. pressure per square inch. The old cast-iron main which was isolated was also tested until it held a pressure of 5 lbs. per square inch for two hours. It was quite expected that difficulty would be experienced before this old main would be equal to taking this pressure without leakage; but it is interesting to note that it was only necessary to open-out the ground to improve four joints, which in all cases were found to be turned and bored.

As there are about fifty consumers between Stafford and Penkridge, it was necessary to put a governor to each service; and this was done by means of Bryan-Donkin high-pressure governors, fixed on the inlet of each meter, which proved to be quite satisfactory. The outlets of these governors are set to give a constant pressure of 3 inches. At the point where the 6-inch main is joined into the existing cast-iron main, a Bryan-Donkin district governor is fixed under the footpath in a pit; so that only the pressure absolutely necessary to supply the Penkridge requirements needs to be put on to the old cast-iron main. Up to the present time, this has proved to be 20 inches water gauge. At the Penkridge end, the 4-inch main was connected to a small gasholder of 6000 cubic feet capacity (which was already in existence). On the inlet of this a Bryan-Donkin automatic valve was fixed; so that when the holder is full of gas it is automatically shut off from the high-pressure mains. There is, therefore, no need to keep a man at Penkridge to look after the filling of the holder; it being impossible to overfill it. The construction of this valve will be seen on reference to A and B on drawing No. 3.

For the purpose of supplying high-pressure gas to the mains, a duplicate set of the Bryan-Donkin Company's rotary compressors was installed at Stafford—see drawing No. 4. These are driven by means of 3 H.P. electric motors direct coupled; and as they are fixed in the meter-house, they are of the totally enclosed type. The compressors are each capable of supplying 6000 cubic feet per hour at 80 inches pressure; and by a governed bye-pass arrangement any pressure up to this amount can be put on to the

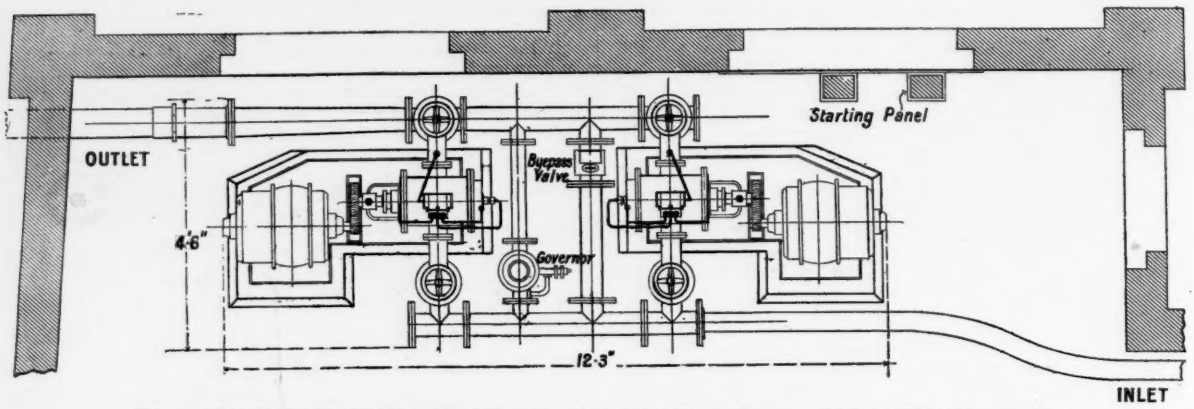


Fig. 4.—PLAN OF DUPLICATE COMPRESSORS—CAPACITY OF EACH, 6000 CUBIC FEET PER HOUR.

mains. A new two-storey building was constructed at the old Penkridge Gas-Works, the ground floor of which is divided into two parts, one of which is used as an office and the other as a meter and governor house. In the latter part, a 500-light dry meter and a 6-inch governor—both supplied by Messrs. J. & J. Braddock, of Oldham—are installed; so that the whole of the gas delivered on to the district is measured, and it is easy to know exactly the leakage. Before being metered, the gas passes through the governor, which is set to give a constant pressure of 3 inches water gauge.

The screwed and socketed pipes made a very fine job. They are very easy to lay; the cost for labour being very small. To show the facility with which the work can be carried out, it may be mentioned that a length of 800 yards of 6-inch pipe which was laid through the principal street of Stafford was completed in five days with only seventeen men employed. The mains where they pass through the town are laid under the footpath, and outside the town under the grass in the road-side waste—all with at least 18 inches of cover. Should it, therefore, be necessary to get at the mains at any time, it can be done without disturbing the road traffic. The mains were laid at an average rate of 190 yards per day, with 24 men employed.

In order that tees, bends, syphon pots, &c., could be fixed at exact points, it was necessary to cut and screw the main in places; and this was done with a machine purchased from Messrs. Lindley, of Sheffield, which was fixed in a central position to the length of main being laid. The machine is so easy to work that a youth can cut and screw a 6-inch pipe. Before screwing up the pipes, the precaution was taken of coating the screwed ends with graphite paste, although the makers claim that with their special screwed joint there is no need for this. It should be mentioned that all specials—such as tees, bends, &c.—were of steel.

The 6-inch main was laid right through the centre of the town so as to pass down the principal street; the idea being to connect up thereto high-pressure lamps and hire them to shopkeepers. With this object in view, three 3-inch branches were laid across the street; so that should shopkeepers on that side want high-pressure lamps they could be joined up by small mains connected to these 3-inch branches. Another reason for taking the high-pressure main through the principal street was that there are a number of important thoroughfares leading off it, and it is hoped to light them presently with high-pressure lamps. A fair amount of high-pressure lighting in the main street has already been obtained; and it may be interesting to mention that the London and North-Western Railway Company have given out a contract for re-lighting the whole of Stafford passenger station by means of high-pressure gas-lamps.

Cost.

The cost of laying these mains was as follows;—

	6 Inch. Per Yard. s. d.		4 Inch. Per Yard. s. d.
Cost of mains delivered, *ex* railway .	5 3¾	..	3 6¾
Cost of laying, including all labour, cartage, materials, &c.	1 2	..	0 10¾
Total	6 5¾	..	4 5½

The Penkridge people have welcomed the supply from Stafford in a very gratifying manner. The largest output for one year under the old Company was 1,900,000 cubic feet, with a leakage of 14 per cent.; and for the first twelve months after joining up from Stafford the output has been 3,865,000 cubic feet, with a leakage of 3·25 per cent. The daily output is still increasing; and as most of the people have already applied for gas, within a short time practically all the houses will be joined up, when it is estimated that at least 5,000,000 cubic feet per annum will be consumed. Below is a comparison of the number of consumers and various apparatus in use at the time of taking over the old Company and to-day.

	Old Company.		Now.
Consumers	155	..	211
Cookers and fires, &c. . . .	52	..	165
Consumption	1,900,000	..	3,865,000

Financial Aspect.

The total cost of purchasing the Penkridge works, laying all connecting mains, compressors, &c., was £4500. The profits received from sales of gas for the first twelve months has been £550, sufficient to pay just over 12 per cent. interest on the outlay of £4500.

This year the Stafford Corporation were approached by the West Staffordshire Gas Company, who supply gas at Brewood, 5½ miles beyond Penkridge (or 12 miles from Stafford), for a supply of gas in bulk. A satisfactory guaranteed minimum consumption being agreed upon, it was decided to lay mains on from Penkridge, through the villages of Gailey and Stretton, to Brewood. The whole of the work was carried out by the Stafford Corporation; the West Staffordshire Gas Company paying the cost of the main from the end of the Stafford area, which is 9½ miles from Stafford.

The supply having increased so rapidly at Penkridge it was decided to erect a 60,000 cubic feet holder there to replace the old 6000 cubic feet one. This new holder will be large enough to supply both Penkridge and Brewood for many years to come. The total distance from the new holder to Brewood is 9661 yards, or nearly 5½ miles; and 7497 yards of this has been laid with 6-inch and 2164 yards with 4-inch main. The type of pipe used is mild steel, lap-welded, coated, wrapped, and re-coated, with Stewarts and Lloyds long sleeve joint. The 6-inch pipe is No. 7 gauge; and the 4-inch, No. 9 gauge. The patent long sleeve socket joint (marked C on drawing No. 2) is strengthened at the collar in the same manner as the ordinary patent inserted joint; but the socket is lengthened—the male end being made so that it is a driving fit into the lengthened portion of the socket. It is then finished with yarn and lead in a similar manner to the ordinary inserted joint. The gas will be supplied through this main at low pressure from the holder at Penkridge.

Costs.

The cost of laying these mains has been as follows:—

	6 Inch. Per Yard. s. d.		4 Inch. Per Yard. s. d.
Cost of delivery, *ex* railway	5 4½	..	3 6½
Cost of laying, including cartage, labour and materials, &c. . . .	1 3¾	..	1 1½
Total	6 8¼	..	4 8

It is very interesting to compare these costs with those for screwed and socketed pipes so far as labour is concerned, as it shows in a striking manner the great saving in labour and materials when laying screwed mains—cost for excavation, &c., being the same in both cases. It is also interesting to note that every house on the new line of main has already applied for a supply of gas. As this work is not yet quite completed, the actual financial results cannot be stated; but the consumption which is guaranteed by the West Staffordshire people is alone sufficient to pay 5 per cent. on the capital outlay.

DISCUSSION.

The President (Mr. W. S. Morland) remarked that the paper was a very interesting one, and was now open to discussion. He hoped the members would keep to the point; so that everyone who wished might have an opportunity of making remarks.

Mr. George Helps (Nuneaton) said the members were all interested in distribution, and a paper like this was a great help to everyone of them. He knew that Mr. Valon had read the paper with the view that those who did not agree with what he had done should say so. First of all, the most important matter of any was that of joints. Some ten years ago, when he (Mr. Helps) started high-pressure work, he had communication with some friends in America. They said to him: "High-pressure is excellent; you will find it will do everything you want it to do. But for goodness sake do not use lead in any shape or form in your joints." He set out on this advice. The Mannesmann tube people had the contract; but, for some reason or other, they did not want to give him screwed pipes. They argued that lead, with a properly caulked joint, would stand any pressure that he would

require. In fact, they said that they could show him an ordinary socket-and-spigot joint standing 1200 lbs. water pressure. They asked him whether he was going to put 1200 lbs. pressure on the pipe. His reply was that if they could show him the joint, he would be satisfied to put in open joints. He journeyed down to the Mannesmann works, and saw the mains jointed together, and tested under the pressure named; and there was not the slightest leak. He therefore decided to have open joints. There was a good deal of weeping after that. [Laughter.] Three miles of the mains were laid, and tested to 60 lbs. air pressure. The mains stood this; and they thought this was a good test. They watched the gauge, and were quite satisfied they had made a good job of it. When he told the members that, when he put gas into these mains at 20 lbs. pressure, they were losing 20 million cubic feet a year on the three miles, members would well imagine what sort of a time he had of it. They opened out the joints—every one of them. They caulked and fiddled with them for a long time, and reduced the leakage very considerably; but they never satisfactorily got rid of it. He should say these three miles of mains cost thousands of pounds through the gas that was wasted. The time came to extend the main; and he then thought he would go in for screwed pipes. But before he laid the screwed pipes, he looked into the question of their soundness, and spent most of his time for six months testing screwed and all sorts of joints; but he came to the conclusion that screwed pipes would not suit him. One could get a sound joint. But he did not believe one could get many joints together that would stand the first time that they were set up; and when one began to fiddle with them, then further trouble started. With this they came to welded joints. Welded joints would stand as long as one liked. They were as strong as the pipes themselves; and they did not leak any more than the pipes. The three miles of open-joint pipe were taken up; the sockets were cut out; and then the pipes were welded-up. When they had done this, it brought down the leakage from 15 per cent. to 8 per cent. This was for the whole of the district; and he should say that they had about 13 miles of low-pressure main in which they had an average pressure of 30-10ths, and about 14 miles of high-pressure mains in which they had a pressure of from 5 to 7 lbs. History repeated itself. There were a good many of his friends who visited Nuneaton to see these things. He told them of his experience with lead; and they went away and put in lead. [Laughter.] He did not think there was any man in the room who would differ from him in this: Had lead the physical properties to stand this work? His only wonder was that it stood so well as it did. If lead were subjected to vibrations, they got in it a permanent set and it must leak. Conditions, of course, varied in every district. Mains could be put in with lead where there was no vibration; but where they were subjected to vibration, the result was altogether different. With regard to pressure, it was becoming more and more difficult to define high pressure from low. When Mr. Valon talked of 100 inches, he (Mr. Helps) was compelled to say he did not consider that a high pressure. At the present day, they were dealing with hundreds of pounds pressure. Only within the last three weeks, some work had been carried out which was subjected to a test of 300 lbs. per square inch; and it was found absolutely tight at that. In connection with the question of joints, the matter of cost came up. He had not gone into the figures in the paper. But his experience was that the spigot-and-socket and lead joint was the dearest; next came the screwed joint; and the welded was the cheapest of all. There was no patent about the welded joint, so that anybody could use it. He did urge anyone who was about to lay mains to look seriously into this question of the welded joint, because it had been such a huge satisfaction to him to have found something that would really stand under any circumstances. Another point of interest was that of connections to the mains. Mr. Valon had shown them illustrations of clips and joints. When they pulled up the three miles of mains at Nuneaton, they had an opportunity of seeing all sorts of clips and things that they had arranged in the early days. He should have liked the members to have seen them. There was no doubt that the joints shown on the drawings were excellent ones in their day, and better than he used originally. But he did not think that any of them were quite up to the joints that they were now using. The present joint was simply a clip which made joint on to the main, a nipple being used which screwed (through the top flange) through the main itself. The object of this was that whatever happened to it, it could not slip, as was the tendency of the old form. If they could get a joint that could not get any twist, and one that was tight between the top flange and the outside of the pipe, it would stand 1000 lbs. pressure; and there would be no possibility of it ever slipping. Mr. Valon had said that one of the joints that he had shown—metal to metal with a tapered hole in the main—he would not recommend for high-pressure work; but this was the sort of thing they used at Nuneaton. There was another question now that simple joints could be made which were quite cheap, and which were likely to stand as long as they were wanted. Of course, dealing with 100 inches pressure, Mr. Valon wanted for his high-pressure gas, a main of larger size than he would have done if he had gone in for 100 lbs. pressure. There were, of course, all sorts of cases—cases that had each to be considered on its own merits; and he was not criticizing this portion of Mr. Valon's paper, because he (Mr. Helps did not know sufficient about the conditions. But if Mr. Valon could have laid a smaller main, by using a higher pressure, the cost would have been less; and he would have found that he would have obtained better results for the customer. The chief advantage of high pressure, as he understood it, was lost unless one went to high pressures, because one wanted a surplus of gas in the mains, so that each customer might have a constant pressure for every part of his purposes year in year out—whether he had in use 100 or 1000 burners at any time. This was another important point that few of them had realized; and no variation of pressure such as they were now accustomed to should be any longer tolerated. With (say) variations of 10-10ths to 15-10ths, it was impossible for progress to be made. When they could give a constant pressure of 30-10ths, he thought that it would be found there was no necessity for going in for high-power lights. This was his experience for the last ten years.

Mr. C. H. Webb (Stourbridge) remarked that Mr. Valon stated that his mains were 20 to 23 feet long. In high-pressure work with which he (Mr. Webb) had been connected, they had had tenders for lengths of 27 to 35 feet; and it seemed to him if they were going in for long lengths of pipes, they might as well do so to the fullest practicable extent, so as to save joints. He should like to know if Mr. Valon could not have got longer pipes without extra cost or difficulty. He (Mr. Webb) had always had a leaning towards the expanding nipple as making a good job; but Mr. Valon said from the experience he had gained, only saddles were now used. Another question was that in fixing the Bryan-Donkin high-pressure governor on the inlet of the meter he took it that the governor had a safety vent to the open air in case it failed; or did Mr. Valon rely on the governor acting continuously? In speaking of the profit earned, he should like to know whether a differential price was charged to the villages, over and above the standard price in Stafford; also whether before going into a village, Mr. Valon had found any advantage in canvassing. He (Mr. Webb) had never found that people could be got to say definitely whether they would take a supply of gas until the main was actually laid past the door of the house.

Mr. H. J. Woodfine (Wellington, Salop), speaking with regard to the profit from the work carried out to Brocton, said it seemed to him that a profit of 12 per cent. was an extraordinary one. He found from the figures Mr. Valon had given them that he had to lay 5825 yards of main; and taking the prices of the two sizes laid, the main was 3s. per yard. This came to a total outlay of something like £875 for the work. Taking 12 per cent. on this amount was, in round figures, £100; and Mr. Valon stated that his profit was 12 per cent. on this very outlay. The income from twenty small houses he (Mr. Woodfine) reckoned at 50s. each, which would bring in £50. The six large ones, at £10 each, would bring in £60. This made a total revenue of £110. If Mr. Valon got a profit of 12 per cent. from the sale of gas, he (Mr. Woodfine) could not see where it came from.

Mr. F. J. Ward (Knowle) said he had had some experience of laying these particular mains, excepting the screwed joint. In speaking first of the supply to Brocton, Mr. Valon stated that he had used Stewarts and Lloyds inserted form of joints, and that the mains were covered. He (Mr. Ward) had gone away entirely from covered mains, because the subsoil in his district was of such a character that pipes laid in it practically lasted for ever. He had never had occasion to take out a wrought-iron service pipe through ordinary decay; and the works had been in existence forty years. He said "ordinary decay," because there had been cases of decay where pipes had been laid in ashes, but that was not ordinary. In laying these mains, he had one section simply coated with Dr. Angus Smith's solution. This was two-and-a-half years ago; and he had watched this section of main very closely. He had opened it up at spots where he thought decay might occur. But he had found no signs of it. He was going on with this particular kind of main when any further extensions were needed. In regard to the inserted joint of which Mr. Valon spoke, his own experience had not been at all satisfactory. The joint was much too short; and with it one could not use ordinary lead wool or lead wire satisfactorily. The recess was so deep that one could not fill it up; and unless the recess was filled up quite deep, the joints would draw or shake out. It seemed to him that the best course to pursue was to yarn up as far as possible, then fill with lead wool, and finish with about ¾ inch of molten lead. With regard to clips, Mr. Helps had given them his opinion on this point. Strange to say this opinion was exactly the same as his own. He found that the very best kind of clip he could have for a steel main was an ordinary flat one, 2½ in. by ⅜ in., made by his blacksmith. This he clipped on to the main, put in a thin sheet of lead, and drilled through it into the main. With this they had no movement at all. With the usual form of clip, there was a sliding movement; and they probably found that half the hole was covered. He should like to ask Mr. Valon why he used so many kinds of joints. Was it simply to gain experience? If so, would he give them an account of the experience rather more fully. He (Mr. Ward) had been in the same boat himself; and had used various kinds of joint simply to ascertain which was really the best.

Mr. T. Berridge (Leamington) thought the paper an excellent one, and one which would be of great advantage to them all. One of its lessons was that they ought to be a little more plucky, and go out more to the neighbouring villages. In their towns, they had the competition of the electric light; there was no such competition in these neighbouring villages. It was their duty, and would be to their profit, to extend their mains, as much as they possibly could, to give the villages the advantage of a supply of gas. The man who got there first had a long pull over the other man.

He concurred with the remarks made by Mr. Helps. He (Mr. Berridge) had come to the conclusion the proper thing was the welded main. He had laid many miles of the kinds of mains with the joints described in the paper. But from his experience, he thought he should eventually go in for welded joints.

Mr. WARD said there was one point he had omitted. Mr. Valon said that he had governors on his main between certain points. Did he find them "build-up" at all when there was no consumption going on?

The PRESIDENT said he could give the members a little experience regarding mains he had had to take up in Gloucester. He strongly objected to coated pipes; and he would on no account again have a socket coated with Dr. Angus Smith's solution. He preferred metal to metal. With the socket coated, they could make a perfectly tight joint for the time being; but they would find that the gas would later come through the yarn, and attack the coating of the spigot, and in due course there would be a leak. He knew a case where a supply of gas was taken to an asylum. The engineer suggested that he should lay the mains; it being a considerable distance. But the surveyor in charge of the work preferred to do his own main-laying. The engineer advised him not to lay coated pipes; but he thought he could do better, and put down coated ones, thinking the life would be longer. After a time, the leakage began to be tremendous; and the surveyor complained that the gas company were sending out gas saturated with tar. The syphon was filled with tar; while when the supply was first put on, there was nothing in the syphon. The fact was these coated pipes were laid, and the gas dissolved the coating; and it was deposited in the form of tar in the syphon. Hence the leakage. There was one question that he should have liked to ask Mr. Helps, but he had gone. That was whether the pipes to which he referred, and which leaked, were coated with tar.

Mr. BERRIDGE said he could answer the question. They were coated, but not on the spigots. There they were clean.

The PRESIDENT added that very often the pipe-makers asked engineers to take coated pipes; but he strongly recommended the members never to lay them.

Mr. VALON, replying to the discussion, said he would first deal with the question mentioned by the President. In no case in connection with the pipes that he had laid were the faucet ends coated. The pipes themselves were coated in a special way with a special machine. They started with a long sleeve joint, 8½ inches from the end, before the coating commenced; and the whole of the coating was done in one operation at the makers. In reply to Mr. Helps, he quite agreed with him that, if they were going to use very high pressures, then welded mains and welded joints were undoubtedly the best. The pressures in his own case were not exceptionally high. Under 1 lb. to 1½ lbs. was the maximum; but perhaps later it would go up to 2 or 2½ lbs. The highest pressure there was likely to be on the main was about 5 lbs. As to the cost of joints, he totally differed as to the welded joint being the cheapest. It was the dearest. He had tenders for welded mains; and the difference in cost was over 30 per cent. in favour of the mains used. Had they used welded mains, they would have paid 30 per cent. more; and the mains would have been two gauges lighter. The cost for a 6-inch welded joint to-day was 2s. 7d. The cost of the joints as he (Mr. Valon) made them was 2s. 1d. Therefore, the welded joint was considerably dearer. Coming to the point of leakage, he thought that, without being egotistical in any way, he could claim to have some knowledge of the subject. Their leakage had been for four years 2 per cent.; and they had been able to save on this ½ per cent. They took a little bit of care of the mains; and the care showed on the leakage. They found that the loss was not so much on the mains as on the services. The way the services were laid and connected-up had a large influence in this direction. If a manager had a big leakage account, and he started to test his services, the leakage there would simply open his eyes. He should say that at least 90 per cent. of the leakage to-day was practically from services, whether long or short. As to the question that Mr. Helps raised regarding the laying of a smaller main, the point he (Mr. Valon) had to consider was that the main already laid was of a certain size. He was using 3½ miles of these mains; and it was cheaper therefore to put in 6 and 4 inch steel mains. As to connections, the reason they discontinued using a nipple was that the average workman did not make a good job of it. If properly made, it was an excellent joint; but the average workman did not get his screws home tight enough. The saddle and metal-to-metal joint was perfectly satisfactory for pressures up to 20 inches. If they went above this pressure, there was now a joint which was made parallel with a lead washer—the same as if one were using an expanded nipple—and this was perfectly satisfactory. Mr. Webb asked about the length of the pipes. The lengths adopted in his case were cheaper than the 30 to 35 feet lengths. If he could have procured the longer lengths at anything like the prices of those used, it would have been so much the better. Of course, the longer the mains, from the jointing point of view, the better. As to the governors, they were of the mercurial type, and each one was confined in a case, with a ¼-inch pipe for an air-outlet. The pipe was taken outside; and, in the event of any blowing, the gas would be dispersed outside. As to the price charged, the gas at Penkridge was 1s. more than in Stafford. Respecting the profits from Penkridge, they were obtained by taking the total revenue from the area, and deducting from the actual revenue the average cost of making the gas for the twelve months. The total cost last year was 1s.; and this was deducted from the revenue. The price of gas in Stafford was 2s. 6d. for lighting, and 1s. 4d. for power; and at Penkridge it was 3s. 6d. and 2s. 4d. respectively. In regard to canvassing for customers before laying new mains, it was perfectly useless; satisfaction was never obtained. One might get a general idea from the better class houses; but never from the smaller houses. But in regard to the latter, he found that if he put a good proposition before the tenants, they would take the gas when the main was at their doors. If Mr. Woodfine would look at the paper again, he would see that the distance to Brocton was not upwards of 5000 yards but only 1655 yards, which was quite a different proposition. If he worked this out, he would find a different position in respect of profit. Concerning the use of three different kinds of joints. In the first place, he employed an ordinary inserted joint. He agreed with the remarks that had been made that the ordinary inserted joint made a good job; but it did not make the best of jobs. A much better joint was the long sleeve or rigid joint. The reason why he used the screwed joint in the Penkridge main was that when they bought the mains the Association had not control, and he was able to purchase the mains at the same price as he could buy inserted joint ones. It seemed to him then that the screwed joint would be infinitely better. When they put 10 lbs. pressure on them, they could not find any leakage. They actually held 10 lbs. pressure for ten hours without losing 1 lb. in pressure. The temperature was carefully taken. It was summer time, so that the temperature, registered at the same hour, did not practically vary; and beneath the surface where the pipes were, he doubted whether it varied at all. This was with the screwed joint. When they came to consider the Brewood main, they found the Association had taken up the screwed joint. They controlled it; and they said they could not allow it to be competed for. When they got away from this joint, they had competition. The result was they got down the cheaper job; and this was the reason they used the inserted joint on the Brewood work. He had had the inserted joint up to 150 lbs. pressure on a long length of main. It kept there for weeks, and did not lose 1 lb., taking temperatures into consideration. If he could get welded mains at anything like the price of these mains, he would have them. He had not expected any trouble from the banking-up of the governors; and had not found a variation of 1-10th throughout the twenty-four hours. The outlet pressure was set at a constant of 3 inches. They had had any amount of charts taken; and the variation, as he had said, had not been 1-10th in the twenty-four hours.

Typical Intensities of Artificial Illumination.

The following table is taken from an address by Mr. Preston S. Millar, the President of the American Illuminating Engineering Society, on "The Status of the Lighting Art:"

Class.	Foot-Candles. Average.	Usual.	Range.
Street lighting—			
Principal streets in cities	0·40	0·25	2·00
Important side streets	0·15	0.10	0·25
Residence streets	0·04	0·01	0·10
Store lighting	4·00	2·60	
Factory lighting	3·00	2·60	
Office lighting	3·00	2·40	
Residence lighting	1·50	1·30	
Railway car lighting	2·00	1 30	

The street lighting was measured on a horizontal plane of street surface; and the store and other lighting, on one 30 inches above the floor.

Royal Society of Arts.—The 160th session of this Society will open on the 19th inst. with an address by the Chairman of the Council, Colonel Sir Thomas H. Holdich, K.C.M.G., &c. During the session there will be five courses of Cantor Lectures, one of which will be by Dr. W. A. Bone, Professor of Chemical Technology at the Imperial College of Science and Technology, on "Surface Combustion." There will be three lectures, and they will be given on March 16, 23, and 30 next year.

Manchester and District Junior Gas Association.—The second of the series of lectures arranged to be held in the Manchester University (Physics Theatre) will be given by Mr. H. James Yates, F.C.S., M.Inst.Mech.E., next Saturday, the subject being "Recent Progress in Gas-Fire Science." The chair will be taken by Mr. S. Tagg, of Preston. After the lecture, tea will be provided at Carlton House; and this will be followed by an informal discussion on "Gas-Fires, the Fixing and Maintenance of Same," which will be opened by Mr. A. M. Taylor, Outdoor Superintendent, of Stretford.

Scottish Junior Gas Association (Western District).—We learn from the Hon. Secretary and Treasurer (Mr. David Fulton, of Helensburgh) that the members of the Western District Division of the Association will next Saturday afternoon visit the Cambuslang Gas-Works, where they will have an opportunity of inspecting the installation of Glover-West vertical retorts which has recently been started. After going over the works, the members will be entertained at tea by the Directors of the Cambuslang Gas Company. At the next ordinary meeting, to be held on the 29th inst., Mr. J. Lord, of the Manchester Furnaces, Limited, will deliver a lecture on "Gas-Furnaces." It will be given in the newly-equipped furnace-room at the Milan Street workshops of the Glasgow Corporation, and be illustrated by examples.

THE GAS-FIRE.

By HAROLD HARTLEY, M.Sc., Chief Chemist to the Richmond Gas Stove and Meter Company, Limited.

[A Lecture delivered to the Yorkshire Junior Gas Association at Leeds University, Nov. 8.]

On one or two occasions lately the members of the gas-fire industry have been informed by outside observers that they are making but little advance. Even so recently as at the British Association meeting in Birmingham this year the statement was made that the gas-fire is a highly inefficient appliance; and it was implied that those associated with the business are only now waking-up to the potentialities of gas for domestic heating. For this reason, when your Secretary did me the honour of proposing that I should deliver the inaugural lecture this season, and expressed a preference for a discourse on the subject of gas-fires, I felt that it would be opportune, by using the findings of the Gas Heating Research Committee as the basis of my remarks, to show that certainly during the last six years—for it was in November, 1907, that the Committee commenced their actual investigations—a very marked development has taken place in domestic heating by gas, and further, that it would be interesting to see to what extent the suggestions of the Committee have been followed.

METHOD OF DETERMINING RADIANT EFFICIENCY.

As you are all aware, a means of determining the efficiency of a gas-fire was first of all devised; and the method suggested serves at the present time as the standard for estimating the relative values of these fires. As my remarks will be based largely on a consideration of radiant efficiency and its determination, I may be excused for inserting a brief description of the method itself, and indicating a possible source of error in that method, for the modification of which no suggestions have been made so far as I am aware. Those who adhere to this means of testing employ a 12-inch square radiometer for obtaining an absolute value for the heat emitted on to 1 foot square of hemisphere of radius 34·4 inches, at the centre of which is situated the fire under examination, and then, by means of a thermopile, take an observation at the centre point of this area, and afterwards at the centre points of the remaining 80 areas into which the hemisphere is divided, and calculate from the relative thermopile values the distribution of heat over the hemisphere, taking into account the fact that the areas decrease as one approaches the poles.

We have found that, owing to the large amount of heat emitted by the gas-fires to be examined, it is necessary to place in front of the board which forms the support for the various portions of the radiometer, a sheet of asbestos held at a distance of about 2 inches from the front of the radiometer itself, so as to prevent any additional heating-up of the water in its passage to and from the radiometer tubes by heat conducted through the woodwork of the instrument. Without this protective sheet, the framework of the instrument becomes hot when placed in front of a modern fire, and an error may be introduced in this way. Of course, the small glass reservoirs through which the water passes, before and after the radiometer tubes, are encased in slag wool, or some such non-conducting material, and all tubes are lagged. Nevertheless, after continued use, this heat insulation is liable to get shaken out of position, and, being out of sight, may be overlooked. In addition, there is a length of lagged tube through which the water flows in close proximity to the board, and the copper tubes are framed in wood.

A careful examination of the R. H. Smith radiometer will show that a protective sheet of the nature indicated above is essential. Further, in the determination of the necessary convection correction, the water can be started flowing through the radiometer, and the latter be placed to one side of the fire sheltered from direct radiations. If it is placed in position in front of the fire from the start, it is found that, with some of the larger fires, four asbestos sheets, each separated from its neighbour by a distance of about 2 inches, are required to stop radiant heat reaching the face of the instrument, and are necessary to enable a proper convection correction to be obtained. If care is not observed in the determination of this correction, an error may easily be introduced. It is preferable to determine the heat taken up by the water flowing through the instrument in a definite period, and not to be content with the observation of the difference in temperature between the inlet and the outlet thermometers. We have found it advisable to employ a more sensitive galvanometer thermopile unit than that used by the Gas Heating Research Committee in their work, so as to enable us to obtain a centre reading of the order of fifty deflections with a fire. By this means the experimental error is lessened. The order of the difference which may be obtained is indicated by the following. In the test of a particular fire, using the more sensitive galvanometer, a thermopile factor of 22·22 was obtained; then, upon introducing a less sensitive galvanometer, giving a centre reading of 9·4, a thermopile factor of 23·11 resulted. This difference was equivalent to 2 on the efficiency results, which were 52·1 per cent. with the more sensitive galvanometer and 54·2 per cent. with the less sensitive one.

In the Leeds method, two assumptions are introduced. The first is that the thermopile readings taken at the centre of each of the areas truly represent the mean density of the heat for each of the areas. Table I. shows thermopile readings taken along the equator from the position 80° E. to the position 80° W., at intervals of 20°, together with those taken from 85° E. to 85° W. at intervals of 5°, and, further, the corresponding readings along the meridian 0. [*Vide* Table I.]

From these figures I note that there is a slight difference between the actual readings obtained at the various positions 80°, 60°, &c., and those calculated from the mean of the two observations taken at 5° on either side. An examination of the totals obtained by direct reading and by the indirect reading indicates that the error introduced by assuming that a reading taken at the centre of each area represents the density of the heat distribution for the whole area is probably negligible. The differences between the two sets of figures are such as would not be apparent with a much less sensitive galvanometer.

The second assumption made in this method is embodied in a statement on page 15 of the 1909 report, where it says: "Thermopile readings were taken at the centre of each of the areas. Then the amount of radiant energy falling on the areas was proportional to the thermopile readings, whether in millivolts or °C., and to the size of the areas." This excerpt made from the Committee's report really includes the two assumptions contained in the method.

I have already dealt with the first, and now wish to consider the second, which is that the thermopile readings obtained at the different positions vary directly as the amount of heat falling on an area of 1 square foot surrounding the point at which the observation is taken. We made two radiometer determinations—one at the centre position in the ordinary way, and the other at the position 40° E. on the equator; the thermopile readings at these points being taken during the course of the efficiency determination.

TABLE II.

Position.	Radiometer Reading. Observed.	Thermopile Reading. Observed.	Thermopile Reading. Calculated.
Centre ..	72·0 K.C.U. per hour	.. 35·8	.. 35 8
40 E. ..	59·87 ,, ,,	.. 30·1	.. 29·8

It will be seen that the radiometer readings were not strictly in the same ratio to one another as the thermopile readings. This is in part due to the error introduced by the first assumption already referred to, and in part to the second cause, which I wish to discuss. It can be shown on purely theoretical grounds that, provided the thermopile readings represent results obtained under parallel conditions, these vary directly as the heat falling on to the area which each represents, assuming for the moment that the first assumption above is permissible. But the galvanometer reading is an indication of the difference in temperature between the hot and cold junctions of the couples constituting the thermopile; and as this is not very great, a small variation in the

TABLE I.

—	Total Corrected for Area.	POSITION. 85 80 75	65 60 55	45 40 35	25 20 15	5 0 5	15 20 25	35 40 45	55 60 65	75 80 85	—	Estimated Distribution Factor.
		Small negative values	0·6 3·1	15·1 31·2	37·1 43·5	47·5 49·5	53·0 54·0	47·4 39·2	31·6 20·8	8·0 ..	Vertical readings taken from S. to N.	
Calculated . . .	202·3	..	1·85	23·15	40·3	48·5	53·5	43·3	26·2	4·0		24·02
Observed . . .	204·8	..	0·8	22·9	41·0	49·0	54·3	45·2	27·0	1·1		24·08
		0·0 8·1	21·0 31·8	38 4 43·0	45 5 47·1	47·8 47·5	46·9 45·9	43·0 39·3	33·4 24·5	12·7 1·2	Horizontal readings taken from W. to centre and E. to centre.	
Calculated . . .	288·6	4·05	26·4	40·7	46·3	47·65	46·4	41·15	28·95	6·95		..
Observed . . .	287·3	3·0	26·0	41 0	46·4	{48·0 47·6	46·3	41·7	29·3	5·8		..

temperature of the cold junction may invalidate the observation. It is in this way that an error may be introduced in the Leeds method, owing to the fact that the Rubens thermopile, with the galvanometer as at present employed, does not ensure a constant cold junction temperature during the period of observation. The thermo couples are enclosed in a brass case, which becomes heated up during the determination of the heat distribution. If the centre reading is taken at the beginning of the thermopile observations, then when half of the total readings have been recorded, and finally at the end, three different values will be obtained. The following results recorded during the test of a given fire serve to illustrate this point.

TABLE III.

	Start.	Middle.	End.
Centre readings	43·7	43·0	42·3
Total corrected thermopile values	—	954·6	—
Distribution factors	21·84	22·20	22·57
Efficiency results . . per cent.	54·1	55·0	55·9

The total variation is equivalent in this particular case to 1·8 on a 55 per cent. efficiency fire.

To examine this point further, we made several determinations of the distribution factor for a fire (a similar fire to that used in the above test), varying the conditions of the thermopile at the beginning—that is to say, in one case we started with the thermopile cold, and in the other cases we started with it more or less hot. The concordance of results obtained for the distribution factor was better than would have been anticipated from the centre readings. Care was taken that the method of procedure in each case was identical.

TABLE IV.

Centre Reading.	Corrected Total Thermopile Readings.	Distribution Factor.	Radiating Efficiency. Per Cent.	Corrected Thermopile Readings 5° E. to 5° W.	Calculated Thermopile Total.
50·2	1247·6	24·85	59·4	212·8	1225·7
47·0 (1)	1150·9	24·49	58·5	201·4	1160·1
48·5 (2)	1181·0	24·35	58·2	204·9	1180·8

(1) During this series, at the positions 80° S. small negative values were actually obtained.

Centre reading at half-time = 46·8
Centre reading at the end . = 48·3

(2) Centre reading at half-time = 48·8
Centre reading at the end . = 48·0

Eventually, by allowing the thermocouple to stand for a luncheon interval in front of the fire, the deflection fell to 46·3.

On another occasion, with the same fire, two determinations of the distribution factor were made in which the routine was varied. In (1), readings were taken first in latitude 0, and then at the positions in the northern hemisphere, working from 80° N. to 20° N., and afterwards from 80° S. to 20° S., working from E. to the centre and then W. to the centre in each parallel; in (2), the observations were started in 80° S. and were worked straight through to 80° N., moving from E. to W. in each parallel. The results are appended.

TABLE V.

Position.	Heat Distribution. Case 1.	Case 2.
80° S.	0·014	0·052
60°	0·108	0·18
40°	1·541	1·63
20°	4·63	4·67
0° Equator.	6·10	6·10
20°	6·34	6·27
40°	4·19	4·05
60°	1·645	1·58
80° N.	0·036	0·036
Total distribution factor.	24·60	24·58
Centre reading.	50·0	51·7
Observed thermopile total	1230·25	1270·6
Corrected thermopile readings 5° E. to 5° W.	210·6	216·9
Calculated thermopile total	1213·0	1249·2

It will be noticed that the total distribution factors obtained were very nearly the same, but that the actual results for the proportion of the heat in the different parallels vary; those for the northern hemisphere being greater in No. 1 than in No. 2, and those for the southern hemisphere being greater in No. 2 than in No. 1. Actually no such variation would be likely to have occurred in the short interval between the two sets of observations.

The preceding results would appear to indicate that the various readings obtained at individual points on the hemisphere during the course of this portion of the experiment do not truly represent the amount of heat falling on any particular area in terms of the original centre reading. These figures were obtained by taking observations with a 16-inch fire which had been alight for several hours in a room at a steady temperature. The fire used for this test was one provided with a fender, which affected the distribution only in a horizontal plane. The figures given in columns 5 and 6 of Table IV., and the corresponding figures in Table V., are referred to later.

Each experimenter may or may not introduce other mechanical alterations to facilitate rapid, and ensure accurate, working. In the laboratories at Richmond's, we find that it is advisable to have the supports for the semicircular bar to which the thermopile is attached rigidly stayed, as a slight falling away from the true of the supporting pivots introduces a large error. In one case we traced to this cause an error of 5 in the actual efficiency result—due to what at first sight appeared to be quite a negligible warping of the wooden base to which the upper support was attached. During a test of a fire, we measure the chimney pull by means of a delicate pressure gauge, and maintain it as constant as possible by the aid of a suitable damper. In this way we are enabled to compare fires under similar conditions with regard to chimney ventilation. If a fair comparison of the different types of fire on the market is to be made, some such control appears to me necessary.

One objection which we, as gas-stove manufacturers, have to this method is that it is only possible to test with ease the efficiency of one fire per working day. A reliable short-cut method of determining the relative radiant efficiencies (absolute values are not necessary) is required. We have endeavoured to use this method as our basis, and to devise from it a short-cut test; but as yet we have not been entirely successful, although I must confess that pressure of other work has prevented us going into the matter very seriously. At first sight it might have appeared that the corrected thermopile totals obtained with two different fires would have been sufficient to indicate their relative merits; but the figures that I have given already will have shown you that such a comparison is not permissible. If it is desired to work with the thermopile only, then it is essential that the cold junction temperature shall at least be kept constant throughout each particular test, and that there shall be a means of recording it accurately, and of correcting for any change which may have occurred from test to test.

In view of a desire to shorten the method of testing, I was led to calculate how closely the total distribution of heat over the hemisphere from a fire would approach to the distribution demanded by the cosine law, according to which the density at a point on a hemisphere of the energy radiated from a small plain radiating surface situate at its centre is proportional to the angle which the line joining that point to the centre of our radiating element makes with the normal to that element. It was hoped that if the distribution did not actually obey this law, the deviation from it might be such as would lend itself to mathematical treatment based on the assumption that the fire consisted of a definite number of approximately equal sources of heat, and that a correction might have been obtained which could be applied to each fire according to the number of radiants which it contained.

With this object in view, I examined the results which we had obtained with a large number of fires, and found that the total distribution approximated more nearly to that demanded by the cosine law than would have been anticipated. The thermopile values for the segment enclosed by the two meridians 5° W. and 5° E. were taken (these are the observations along meridian 0); and after the area correction had been applied to each, the sum of the results was multiplied by the factor 5·76, which is equal to the sum of the cosines of the nine different angles corresponding to the points in the horizontal plane at which observations are usually taken. In Tables IV. and V., I have given these values under the headings "Corrected Thermopile Readings 5° E. to 5° W." and "Calculated Thermopile Totals." In all the cases given, the calculated result approximates fairly nearly to the actually observed results. In the particular example calculated in Table IV., it will be noticed that in one case the observed and calculated values are in agreement; in one of the other two cases, the observed one is slightly above the calculated one; and in the third, slightly below the calculated value. This deviation may in part be due to the variations of the thermopile readings already referred to. We have in hand at the moment the preparation of a thermopile with an arrangement for controlling the cold junction temperature, with which we hope to go into this distribution question still further.

On the whole I am inclined to the view that, with care, an experimenter employing the Leeds method can obtain, with a given fire, results which do not differ by more than 1 per cent. He must employ a sufficiently sensitive galvanometer and take due care to avoid the introduction of any of the small errors which are liable to crop up, as the method is not by any means one which can be employed by the man in the street.

The fact that one requires an accurate method of measuring the efficiency of a fire is in itself an indication of the advance which has taken place in recent years; and I hope briefly to show, in the remaining time at my disposal, by a consideration of the published summary of the findings of the Research Committee, a few of the points at which actual improvements have been introduced.

On page 22 of the 1909 report are published the conclusions arrived at by the Committee. The first clause states that: "The total radiation from an open gas-fire is about 32 per cent., and this is unaffected by the amount of ventilation through the room." On turning to the second report, I find that, by perfecting the mechanical arrangements, an improved accuracy was obtained, and that, by means of a better adjustment of the fire itself, a considerably increased radiant efficiency resulted. Although the result obtained with the specific fire on which the first report was based is not directly indicated, it would appear to be of the order of 40 per cent., which value further represents about an average

figure for the efficiency of the gas-fires submitted by the various makers. To-day we regard 50 per cent. radiant efficiency as quite usual; and although some of the fires on the market still only give about 45 per cent. efficiency, I am on more than a nodding acquaintance with one set of fires which are capable of giving between 55 and 60 per cent. of the available energy in the radiant form. I think most manufacturers would feel they had a grievance if you implied that they were not able to produce fires which gave a radiant efficiency of 50 per cent.; so that, whereas six years ago an efficiency of 40 per cent. was obtained, at the present day it is possible to obtain almost 60 per cent. from some fires by the same method of testing. Certainly it would appear that in this respect a satisfactory advance has been made, as the Research Committee inclined to the view at the time of their work that 50 per cent. represented the limit for the present type of fire.

In this connection it will be of interest to consider the percentage of the net calorific value of the gas we have at our disposal for the heating of the room by radiant energy in the present type of fire. It is stipulated by many makers that the fire shall be red hot to the top of the radiants, in which case the products leaving the fuel will be at a temperature of 600° C. at least, and the following calculation shows that this involves a loss of about 25 per cent. of the available heat.

In the "Gas World Year Book, 1913," there are given (p. 141) the following data concerning a Birmingham coal gas of 1901.

1 cubic foot of gas on combustion gave 0·5672 cub. ft. of CO_2.
" " " " " " 1·2574 " H_2O.
" " required for " " 5·49 " air.
Calorific value of gas (net) = 553 B.Th.U. per cub. ft.
139·4 K.C.U. "

Assuming that
The gaseous products leave at 600° C., and the room temperature is 25° C.,

Specific heat of N_2	= 0·2416
" " " CO_2	= 0·2248
" " " water vapour	= 0·4664

Then on the combustion of one cubic foot of the coal gas under the conditions stipulated we get

Heat carried away by CO_2	= 4·106 K.C.U.
" " " N_2	= 21·63 "
" " " water vapour	= 7·72 "
Total heat carried away	= 33·46 "

$$\text{Heat available} = \frac{139{\cdot}4 - 33{\cdot}46}{139{\cdot}4}$$

= 76 per cent. on the basis of the net calorific value.

It must be remembered that, in addition, there are very appreciable heat losses due to the cooling action of the atmosphere moving past the front of the radiants, and to the fact that we do not by any means possess perfect non-conductors. On the other hand the upper brick and the fire canopy will add a little to the heat emitted by the radiants.

Products of Combustion.

The next point that arises concerns the elasticity of the modern fire under conditions prevailing in an ordinary chimney-place; and this involves a consideration at the same time of the question raised in Clause 4 of the Committee's report regarding the removal of flue gases. The clause states: "There is no necessity for the products of combustion to enter the room and cause discomfort." Many of the fires at present fitted are used in front of an ordinary coal grate, and means have to be provided to lead the products of combustion from the top of the radiants to the chimney. This is done generally by allowing the products to pass up the face of the brick into a canopy chamber and then out through the flue nozzle; this outlet being in some cases at right angles to the plane of the fire, and in others inclined at an acute angle to it. It is the fact that the stream has to be diverted through an angle of at least 60°, and in very many cases nearly 90°, that is often the cause of any trouble which may exist with the products of combustion.

It may appear at first sight that the more nearly the bottom of the canopy is brought to the level of the radiants, the more sure is it that all products of combustion will pass into the chimney proper. But you may be surprised to learn that, although the canopy edge be brought down almost to the level of the top of the fuels, it is by no means certain for that reason alone that the products of combustion will all pass through the flue outlet, even though the outlet be of reasonable shape and size. That an escape of fumes might occur under such conditions will appear obvious if we consider for a moment what happens to the products of combustion after they pass away from the radiants. As the stream leaves the radiants, it moves inwards towards the back brick, along the face of which it passes, flowing in some cases very distinctly backwards from the line of the fuel, following the contour of the brick closely, provided that there are no very abrupt changes in the sweep of the latter—and the stream may be deflected appreciably by altering the shape of the front of the brick. The products which come up from the radiants just as the fire is lighted pass along the brick, and if the top of the canopy be at any distance above the flue nozzle, the stream will flow past the latter and then strike against the cast-iron projection. A momentary back-pressure will be produced, and the larger portion of the gases will probably pass through the outlet. Nevertheless a portion of the upward moving stream will continue to strike the canopy top and will be impelled downwards along the inner side of the canopy by the gases coming on behind—this movement being aided by the downward convection current resulting from the contact of the hotter gases with the cold mass of cast-iron. Once the products have started to move downwards again, it will be obvious that they may escape from under the edge even of a low canopy, if the atmospheric conditions at the inlet to it be such that there is no defined inward and upward air movement. A similar result could of course happen with a canopy which projects outwards a good distance, instead of downwards. What I am saying may appear to many of you as rank heresy, as, for many years, one of two doctrines has been preached, the first of which states that, provided your canopy projects well beyond the line of the fuel, nothing else matters, while the other states that, provided your canopy comes down near to the top of the fuel, then all will be well. Adhering to the former regardless of other factors would produce disastrous results, and adhering solely to the latter theory might do so in many cases.

Chimney Pull and Hygienic Efficiency.

I have mentioned already that, if there is a distinct movement of air inwards from the edge of the canopy, then of course the escape of products would be prevented. For this reason the question arises: Can it be assumed that there will be an inward movement of air when the fire is in use? Because, after all, a gas-fire is employed in connection with a chimney, so that it will be fairly safe to postulate that there is some inward air movement when the fire is in operation. We have, however, no reliable data to enable us to deduce what chimney pull we can allow for in the construction of our canopy, but we know that the amount of this chimney pull, whatever it may be, is a variable quantity. So that naturally a maker will consider the possibility of getting rid of the products of combustion through the desired outlet without depending at all on the variable factor of the chimney pull.

The problem of doing this is by no means a difficult one, and I hope to be able to show you that to stipulate such a working condition for a fire is by no means to place any hampering restrictions upon the general development of, or even upon the radiant efficiency obtainable from, a fire. I have indicated previously that the problem would be solved if an inward and upward movement of the atmosphere at the edge of the canopy were assured. As the result of some experiments which we made some time ago at Warrington, it was found that one method of ensuring this was to put a ledge on the inside of the canopy, and continue it to within a short distance of the front of the upward flowing stream of gases passing along the face of the brick. In this way we may effectively prevent an escape of products of combustion, which without the presence of this ledge would pass from under the edge of the canopy. By the use of the principle which this ledge involves, we are enabled to work with the canopies higher than would be possible if such a method were not adopted. In fact, I am of the opinion that in most cases, whatever the depth of the canopy, it is essential that the distance from the brick to the inner edge of the canopy should be within two not very wide limits. There is a maximum distance which it is not desirable to exceed, and a minimum distance beyond which the edge should not come, both of which are determined by the position of the outer layer of the stream of products at the level of the bottom of the canopy, and the vertical distance between that point and the flue outlet.

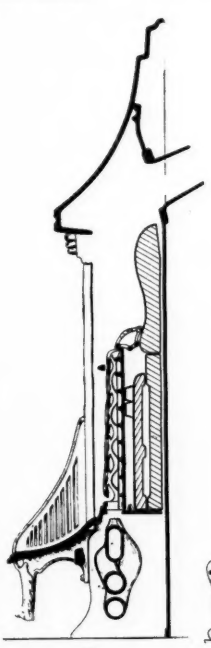


Fig. 1.

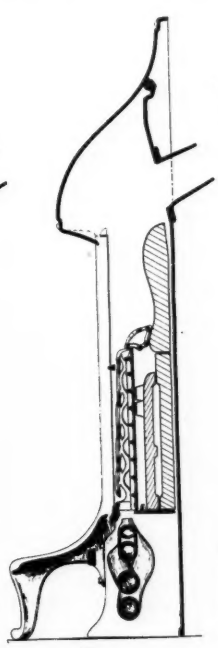


Fig. 2.

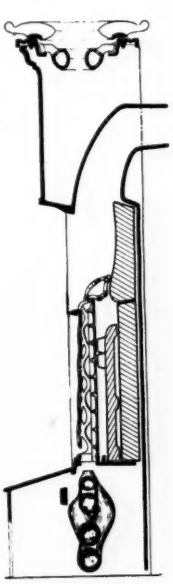


Fig. 3.

From what I have said, it will be obvious that it is not essential that the line of the canopy should project *well* beyond the line of the fuel. Fig. 1 shows a section of a fire which is capable of passing all the products of combustion through the flue outlet, unaided by chimney pull. The ledge on the canopy of this fire projects inwards to within a certain distance of the brick, and its inner edge is but little beyond the front of the fuels. You will notice that especial precautions have not been taken to avoid the existence of pockets in the upper portion of this canopy. If one of these gas-fires is taken, and an inner canopy inserted of such

construction that there is a gradual slope from the edge of the flue nozzle to the edge of the canopy, it will be found that doing so will not enable the edge of the canopy to be raised, provided all other factors are unaltered. In fact, this canopy is as high as it is advisable to go with the present position, size, and direction of the flue outlet.

Now, I have stated that this fire, by virtue of its canopy construction, is capable of passing all products of combustion through the flue outlet, without the aid of any chimney pull; but I wish to go further. If this fire is lighted up when standing in the middle of a room, and tests are made for the escape of products of combustion along the edge of the canopy, it will be found that at first there is a slight leakage, but that in ten minutes or thereabouts, when the upper portion of the casting has become warm, not hot, all the products of combustion will pass through the flue outlet; so that this fire attains the standard previously outlined. The question will arise as to whether this is a sufficiently rigorous demand, as, under ordinary conditions, it is during the first quarter of an hour after the fire has been lighted that the danger of the escape of products of combustion is greatest, and that is a period during which incomplete combustion takes place in a gas-fire. In other words, is a fire which is so constructed that all products of combustion will escape through the flue nozzle unaided by chimney pull *when warm*, hygienic?

In an endeavour to prove that it is so, I wish to bring to your notice the following results obtained during June last, when the climatic conditions were such that we had at our disposal a house chimney in which there was no movement of air, or, if there was any movement, it was not such as we were able to detect with a micrometer pressure indicator, which is stated to be capable of registering pressures of the order of 10,000th of an inch of water. We took one of these high-canopy fires and placed it at the foot of a chimney. Then 5 feet above the flue nozzle of the fire a brass tube was inserted, and this was connected directly with the pressure gauge. At the moment of starting with the chimney cold, the pull recorded on the instrument was 0·0000, and when a lighted taper was held at the fire-place opening, the flame was not in any way deflected. This fire was placed just in front of the recess in which formerly had been a coal fire. The surrounding space was not in any way obstructed. The details of the test are given in the following table.

TABLE VI.

Test-room provided with two doors and three large windows all closed.

Time.	Chimney Pull, Inch of Water.	Remarks.
0	0·0000	Flame of lighted taper unaffected.
	FIRE LIGHTED.	
2 mins.	0·0015	No escape of fumes from under the canopy.
5 mins.	0·003	No escape of fumes from under the canopy. Flame of lighted taper deflected inwards.
10 mins.	0·004	,, ,, ,,
35 mins.	0·006	,, ,, ,, Temperature in chimney at level of pressure tube 51° C. Lab. temperature 27° C.

On opening the door, the chimney pull increased to 0·011 inch of water, the opening of further windows not affecting it. This increase in the chimney pull was, of course, only to be expected, as we had at our disposal for ventilating a certain aeromotive force, which at first was partly used up in overcoming the resistance in the chimney and the resistance to the passage of air through the various cracks and openings in the room. When the door was thrown open wide, the resistance to entrance of air into the room was eliminated, and the full aeromotive force operated in the chimney itself. From this it would appear that the danger of products of combustion escaping during the lighting stage with many fires would be lessened appreciably by ensuring that the door or windows of a room were open when the fire is being lighted. The previous results indicate that there was no escape of the products of combustion into the room at the end of two minutes after lighting; so that, provided there is no down-draught in a chimney, there appears to be little danger of any escape of products of combustion from a fire capable when warm of leading completely all fumes through the flue nozzle without the aid of a chimney pull.

As mentioned already, the Research Committee expressed the opinion that the radiant efficiency of the fire which they tested was unaffected by the amount of ventilation. As some fires of modern design are affected by the amount of ventilation taking place, I was led to examine closely the Committee's results to see whether there had really been a retrograde movement in this respect. On turning to Table I. of the first report, it will be noticed on referring to experiments 15 to 20, which were carried out especially to test this point, that only in two of them—namely, tests Nos. 16 and 17—are both the flue loss and the radiant efficiency given. In test No. 16 the flue loss was approximately 3 per cent. greater than in test No. 17, and the radiant efficiency was approximately 3 per cent. lower. On the other hand, if we go back to tests Nos. 13 and 14, we find that the flue loss was higher in the test in which the higher radiant efficiency was obtained. These results do not appear to me to support their contention. I have indicated that it is possible to increase the accuracy of the method of test by certain small alterations, and having done this we were able to obtain more concordant results on the subject of the effect of ventilation on the radiant efficiency of a fire.

CHIMNEY PULL AND RADIANT EFFICIENCY.

Let us then consider the effect of chimney pull on the radiant efficiency of the type of fire we have been discussing. From a perusal of figures which have been published recently in the Technical Press, no doubt many of you incline to the view that a gas-fire must give a considerably lower efficiency when tested under the influence of an appreciable chimney pull, than when tested with a very small chimney pull. This, however, need not be so. The following tests were carried out with a fire (see fig. 2) in which the distance from the bottom edge of the canopy to the top of the fuels is 4¾ inches. The radiant efficiency was determined by the Leeds method, (*a*) when the fire was subjected directly to the full chimney pull; (*b*) when the products of combustion were passing away under a large hood connected to the chimney.

TABLE VII.

Radiant Efficiency.	Pull in Inches of Water at Flue Nozzle of Fire.	Percentage Flue Loss.
(*a*). 54·2 per cent.	0·011—0·012	26 per cent.
(*b*). 54·8 ,,	0·002	16 ,,
(*a*). 54·8 ,,	0·010	26·6 ,,
TEST WITH ANOTHER FIRE OF THE SAME PATTERN.		
(*a*). 57·7 per cent.	0·010	
(*b*). 58·4 ,,	0·001	

That is to say, when the chimney pull was very largely increased, the radiant efficiency of the fire was decreased only by about 0·5 per cent.—a quite inappreciable amount.

Later I took a fire in which the canopy projected to within 2⅛ inches of the fuel, and subjected it to a similar series of tests. The following results were obtained:—

TABLE VIII.

	Radiant Efficiency.	Chimney Pull, Inches of Water at Flue Nozzle of Fire.
(*a*)	45·8 per cent.	0·013
(*b*)	47·8 per cent.	0·002

In this case the fire suffered a distinct loss in efficiency when subjected to a big chimney pull—a loss which, although not very great, was markedly greater than that suffered by the fire with a higher canopy. The higher-canopy fire cited thus appears to mark another real advance, as it is both hygienic and practically unaffected by the amount of ventilation taking place.

It is not a difficult matter to construct a fire with a canopy so that all the products of combustion are got rid of from the moment of lighting-up without the aid of chimney pull, if such a standard is required. Fig. 3 shows a section of a fire which satisfies these requirements. You will notice that this fire is provided with an inner canopy; and although there is no ledge actually projecting inside the canopy proper, yet there has been retained what I would term the ledge principle—that is to say the size of the inlet to the canopy has been reduced to the desired extent. The use of a ledge of this nature enables a common back to be employed for a variety of designs of fire castings; for, as will be evident, the inner canopy is attached to the ledge portion of the canopy proper, and the edge of this is parallel to the brick, so that any space between the bottom of the inner and outer canopies can be filled in by means of a ledge, and a variety of shapes of outer canopy be employed.

Where an inner canopy is used, however, it is important that care should be observed in determining the relative positions and the joinings of the lower edges of the two canopies. In the case

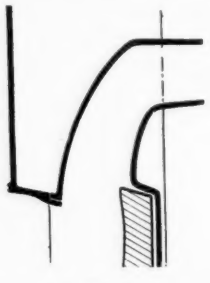


Fig. 4.

Fig. 5.

of the fire shown in fig. 3, the edge of the inner canopy presses down on to the ledge of the outer canopy, and is slightly recessed (see fig. 4). This in itself can be made to give a gas-tight seal, the attainment of which is further ensured by the utilization of a suitable adhesive cement. If any gap were left between the two canopies in this position, then, owing to the suction created by the hot pieces of metal situated close to one another, the products of combustion would be *drawn* through the orifice, and would escape between the canopies into the room. If, however, the inner canopy be provided with the ledge and, as in the

accompanying diagram (fig. 5), this inner canopy be brought to the level of the outer canopy, then there is no danger of products of combustion being drawn up between the two canopies, provided the distance from the ledge to the back brick of the fire be adjusted according to the principle I have already indicated. In that case no seal need be provided between the inner and outer canopies. If, however, in the construction of a fire the inner canopy does not come down to the level of the outer canopy, and there is left a free passage between the two canopies (no ledge being provided on the inner canopy), then the products of combustion will undoubtedly escape by that means, once the fire has become heated up. This is an extremely important point, and one which is often overlooked.

With regard to flue loss. In the tests carried out at Leeds, this would appear to average about 30 per cent. of the total available energy. At the present day the flue loss, determined in the same manner, is probably somewhat lower, and under the average conditions would approximate to about 25 per cent. This varies, however, according to the volume of gas and air being drawn through the flue nozzle—that is to say, it varies with the chimney pull. But any increase in the flue loss should, as I have indicated, be at the expense of convected heat and not at the expense of radiated heat.

On the subject of convected heat I do not propose to spend any time. I would only say that with a fire fitted as is done in many cases—that is in front of an existing coal grate, without the surrounding space obstructed—the amount of available energy of the gas which passes into the room as convected heat is considerably lower than would be calculated on the assumption that all heat which was not radiated or did not pass away through the flue nozzle was given to the room as convected heat.

General Improvements.

Not only has there been an all-round improvement in the working efficiency of the gas-fire, but the designs of the casting in which the vital parts of the appliance are encased have been made much more pleasing to the eye. The highly ornate type of article in vogue some years ago has been replaced by an appliance of more simple design. The finish, too, of the fire throughout has been improved.

The radiant or fuel employed, which is such an important factor from the maintenance point of view, has been improved upon repeatedly by many makers, until at the present day there are on the market one or two really good radiants—radiants which possess mechanical strength, and resist very well the effect of the sudden temperature changes to which they are subjected, and which are efficient as a means of transforming the energy of combustion into radiant heat. The Gas Heating Research Committee in their report indicated that the dipping of a clay radiant into certain solutions would increase the efficiency of the fire. As the question of an efficient radiant is an extremely important one from the gas-stove makers' point of view, we were led some time since to repeat the experiments carried out by the Committee. We were unable to confirm their results, and found that, on taking the radiants out of a given fire, immersing them in a strong solution of copper nitrate, drying, igniting, and then re-employing them, we did not in any way increase the radiant efficiency of the fire. Further, we carried out several experiments with single radiants, and were not able to detect any increase in the radiant efficiency due to the copper nitrate treatment. The results we obtained are appended in Tables IX. and X.

Table IX.—*Thermopile Readings with Single Radiants before and after Treatment with Copper Nitrate.*

	Before.		After.
(1)	55·8	..	55·2
(2)	56·7	..	56·7
(3)	55·9	..	56·1
(4)	56·0	..	55·2

Table X.—*Radiant Efficiency of a Given Fire before and after the Radiants had been Treated with Copper Nitrate Solution.*

	Radiant Efficiency.		Gas Consumption. Cub. Ft. per Hour Net.		Calorific Value Net K.C.U. per Cub. Ft.		Heat Distribution Factor.
Before .	51·6 per cent.	..	34·06	..	155·6	..	23·86
After .	52·0 ,, ,,	..	34·95	..	156·1	..	23·84

The Research Committee's results indicate that they had increased the efficiency of a fire from 42·9 to 48·5 per cent. as the result of treating the radiants with copper nitrate solution [*Vide* tests Nos. 8 and 18, in Table I., second report, 1910].

There has been a demand for a silent burner and a silent gas and air adjuster. These can be obtained at the present day, and as a really silent gas injector marks a quite recent development, perhaps it would interest you if I gave a short description of such an appliance (see fig. 6). The fitting has been arranged so that from each jet the gas streams out at a number of points on the circumference of a circle, and thus gives a cylindrical stream of coal gas which, as it passes into the burner tube, steadily expands. The head of the controlling spindle, which is about $\frac{3}{8}$ inch in length, is provided with a number of carefully cut graded serrations. This spindle works in a collar of definite length, and by screwing it forward we are able gradually to shut off the gas supply completely. Thus it will be seen that, prior to its exit from the fitting, the gas passes down a number of short tubes; and in this way objectionable eddy currents in the stream of gas are eliminated, together with the noise which would be set up by the propagation of vibrations through the surrounding atmosphere. By suitable adjustment of the various parts of the fitting, we are able to reduce the velocity of the issuing gases sufficiently to prevent the formation of these eddy currents, and are yet able to induce sufficient primary air into the burner by means of the gas stream to enable the fitting to work satisfactorily at the varying pressures and on the varying gases supplied in different towns.

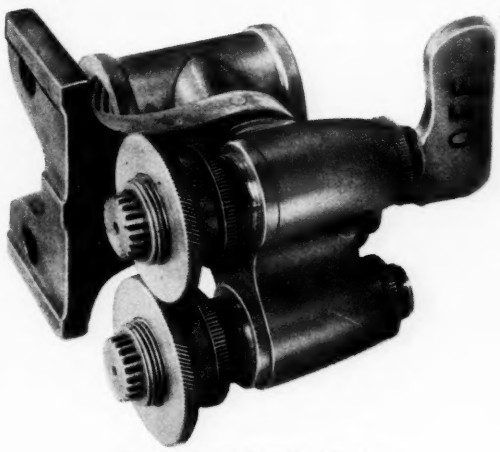


Fig. 6.—Silent Gas-Air Adjuster.

It has been impossible for me to discuss in detail all the improvements which have been introduced during the last six years, but I hope that what I have said will serve to indicate that the modern gas-fire is not by any means an inefficient appliance. In conclusion, I wish to express my thanks to the Directors of the Richmond Gas Stove and Meter Company, Limited, for permission to publish the figures given in this paper, and to the several members of my department who have in various ways assisted me in the collection of the data presented.

INSTITUTION OF MUNICIPAL ENGINEERS.

The Fifth Annual General Meeting of the Institution was held in the Council Chamber, No. 4, Southampton Row, W.C., last Friday. The report presented by the Council showed that the total membership on the 30th of June last was 915, consisting of 728 members, 120 associate members, and 67 students, compared with 882, consisting of 712 members, 94 associate members, and 76 students, at the corresponding date last year. The gross gain during the year was 83, and the net gain 33. The accounts accompanying the report showed an excess of income over expenditure of £121 11s. 3d. or £74 2s. 10d. more than before. Four general meetings, ten council meetings, and thirty-four district meetings were held during the year. The report was adopted.

The President for the ensuing year is Mr. Horace Boot, the Consulting Engineer to the Electricity Department of the Tunbridge Wells Corporation; and in the course of his address he set forth as follows the advantages of belonging to the Institution: (1) The bonding together of all public officials in one common brotherhood. (2) The valuable knowledge imparted by the various papers read and meetings held in the respective districts for the benefit of themselves and the councils under whom they serve. (3) The use of the library and the Institution "Journal." (4) The opportunities of visiting various works owned by public bodies or by large industrial firms. He concluded by expressing the hope that the Institution would "steadily grow from year to year, and make itself felt by always keeping in front of the times and studying the best interests of its members."

The address was followed by the discussion of three papers: "Temporary Buildings in Relation to Bye-Laws," by Mr. T. C. Barralet; "The Need for Standardization in Drainage Details," by Mr. Arthur Palmer; and "Electricity as a Bye-Product," by Mr. R. J. Spencer-Phillips, Assoc.M.Inst.C.E.

In the evening, a *conversazione* was held in the Council Chamber at the Holborn Restaurant, and was attended by the retiring Lord Mayor (Sir David Burnett, Bart.), the Sheriff of London and Mrs. Painter, the Mayors and Mayoresses of the Metropolitan Boroughs, representatives of technical institutions, and gentlemen engaged in municipal and other undertakings. The guests were received by the President. A programme of music, character sketches, &c., was gone through under the direction of Mr. Charles Capper, and during the evening the company were addressed by the President and Sir David Burnett.

Junior Institution of Engineers.—Among the fixtures of the Institution for November was a paper to be read last Friday, by Mr. G. E. Lygo, on "Wood Waste, &c., as Fuel for Gas-Producers." Next Saturday a visit is to be paid to the Saltley Gas-Works at Birmingham.

YORKSHIRE JUNIOR GAS ASSOCIATION.

The Annual Meeting and Lecture of the Association usually are held on the third Saturday in October; the various Junior Associations having divided out among themselves the Saturdays of the month in order to avoid clashing with one another's fixtures and creating an undue accumulation of reports in a given week's issue of the Technical papers. In the present year this date had to be surrendered for the joint visit of the Junior Associations to the National Gas Exhibition; and to avoid the coincidence of date with the recent meeting of the Manchester District Senior Association, a further postponement until Saturday last was necessitated.

The *locale* was as usual the Leeds University buildings, and the lecture was preceded by a Council meeting and a business meeting for the election of officers, &c. To avoid an undue prolongation of the lecture, and to suit the convenience of a good many distinguished visitors, the more formal business matters were pushed forward at a good rate; brevity of speech being the order of the day. The chair was taken by the retiring President, Mr. W. Walker Atley, of Normanton, who congratulated the members on the position of their Association on this, its tenth annual meeting. Its traditions had been worthily maintained; its prospects were bright; and it was opening its session with a lecture on a pressing modern question by a scientist of such eminence as to ensure a valuable addition to the printed "Transactions."

The financial report was presented and adopted. In spite of special expenses in connection with the joint visit to Sheffield of all the Junior Associations, and notwithstanding other items that had tended to deplete the treasury, the year closed with the accounts showing a satisfactory balance on the right side. The general report of the Council summed up the working of an unusually full and busy year, in which the interest of the members had been more than maintained—as was shown by the large attendances at most of the meetings. The session's programme had presented many differing items of importance; the contributed papers had been of high merit; and the complete success of the arrangements made for the Sheffield visit was welcome and gratifying.

The election of officers for the ensuing season resulted as follows:

President:—Mr. C. T. B. Roper, of Bradford
Senior Vice-President:—Mr. J. W. Lee, of Chesterfield.
Junior Vice-President:—Mr. C. V. Townsend, of Wakefield.
Treasurer:—Mr. C. H. Turner, of Mirfield.
Secretaries:—Mr. E. Garsed, of Kippax; and Mr. W. Cranfield, of Halifax.
Council:—Mr. W. Walker Atley, of Normanton (*ex-officio*); Mr. C. D. Cawthra, of Halifax; Mr. A. Edwards, of Leeds; Mr. E. Gillett, of Bradford; Mr. J. H. Hill, of York; and Mr. P. M'Nab, of Bradford.

Mr. Atley then formally handed over his presidential office to his successor Mr. C. T. B. Roper. He thanked the members and the officers for their cordiality and helpfulness towards him during a very full year's engagements, and bespoke a similar treatment and a warm welcome for Mr. Roper. Their new President was no stranger to them either personally or as regards his work for them. He had worthily filled the Secretary's post for some six years, and the Association owed much to him for the labours and zeal of those years.

Mr. Roper briefly returned thanks for the members' welcome and for the high honour of the position to which they had called him. This honour had been quite unsought, and, in fact, he had held on to the Secretary's post longer perhaps than he should have done largely in order to stave off the call to his present position. He would not further detain them or stand between them and the lecture they had come to hear.

The retiring officials were thanked for the year's services, on the proposal of Mr. Demain, seconded by Mr. F. Scholefield, and their acknowledgments were voiced by Mr. Atley.

The company then adjourned to the Chemical Lecture Theatre for the annual lecture, which on this occasion was to be delivered by Mr. Harold Hartley, M.Sc., formerly the holder of the Institution's Research Fellowship at the Gas and Fuel Department of Leeds University under Professor Bone, and now Chief Chemist to the Richmond Gas Stove and Meter Company, Limited. Among the visitors were Mr. Edward Allen, the President of the Institution of Gas Engineers. Lest he should be obliged to leave before the lecture had finished, Mr. Allen was asked to address the members at the onset; the Chairman pointing out that not only had Mr. Allen welcomed them on a visit to Liverpool and been with them recently at Warrington and the London Exhibition, but he had previously been at one of their Yorkshire gatherings when he accompanied the members of the Manchester Junior Association on a joint visit to the coke-ovens of the Thornhill Collieries some years ago.

Mr. Allen thanked the Chairman for the welcome he had extended to him, and the audience for the kind way in which they had received him. It was a very real and great pleasure to him to have the opportunity of meeting them, and listening to their opening lecture. They would be familiar with the old saying that if an old man associated with young men he would keep young, and that if a young man associated with old men he would develop into an old man. Yet as age presumably meant wider and deeper experience, it was after all a good thing for the young gas men to mix with older ones, and occasionally have their company at technical meetings, even as they were that day. Not that he was referring to himself personally, but to the profit they could gain from older men generally. Leeds was quite an important place that day, and many eyes were turned upon it, though for differing reasons. Critical events in the realm of sport concerned some; the Co-Partnership Conference then sitting was of great interest to others, and a number of gas engineers were attending it; while they had the great interest of the pending lecture on gas-fires—and in fact it was just the kind of day to enable them to appreciate the good these fires can accomplish, and what a large and grateful part they play in the comforts of modern life. There was a special interest and a special appropriateness in their assembling in the Leeds University for the lecture, inasmuch as Leeds will ever be associated in the memories of all in the gas industry with the most important research that preceded the wonderful recent developments in gas-fires. Further, their choice of lecture was the more appropriate, because the subject was in very truth a burning question nowadays. No further off than the next Saturday, Mr. H. James Yates was addressing himself to the same subject at Manchester; one of their Technical papers was showing much interest in a certain certificate that a prominent engineer had written about a gas-fire, and a well-known professor was criticizing this same certificate. Truly they could not have chosen a more opportune subject for the opening meeting of their session. He was satisfied they would be much interested and profited by what Mr. Hartley was about to tell them. He had seen and known something of Mr. Hartley's work. He had taken from Leeds a splendid foundation for his work on behalf of the gas industry, and his work both at Leeds and Warrington would prove of great and permanent value. While very glad to see the members gathering for strenuous mental work that afternoon, he did not, of course, imagine that they should give up every Saturday afternoon to business. Both pleasure and relaxation were also necessary.

> "Mix with your grave designs a little pleasure
> And let each day of work have its hours of leisure."

He would have them many-sided, all-round men. Again he thanked them for giving him the opportunity of meeting them, and assured them of his sympathy and interest in their work. He would now gladly resume his seat and listen to Professor Hartley—as they would at least for that day call him.

At the Chairman's call,

Mr. Hartley delivered his lecture [see pp. 513-7], which was copiously illustrated with diagrams, lantern views, actual testing apparatus, and models.

Mr. Roper, as President, formally proposed a vote of thanks to Mr. Hartley.

Mr. J. H. Hill seconded it, and said that he had listened with great pleasure to the lecture; but though Mr. Hartley had stated he was summarizing and somewhat simplifying the more strictly scientific part, he, as a listener, felt he should have liked to have been in a more junior class and heard some of the explanation in a more elementary way. The lecturer had given them credit for knowing all about it (and doubtless many of them would take this credit to themselves). But he had felt rather uneasy when pelted with the cosine law; and in casting his mind back to what he had previously learned about a thermopile and its cold junction, he had to go so far back that, when he had satisfied himself on this point, he had lost touch with the lecturer, who was then far ahead on another matter. It was well for them to have been reminded of the supreme importance of apparent trifles in scientific investigation, of the considerable differences effected by $\frac{1}{1000}$ of an inch chimney pull, and the considerable difference in percentage of efficiency caused by small precautions taken or omitted. It was a good thing for them thus to be initiated into some of the secrets of research work, and to have as a guide so real and eminent a scientific worker as Mr. Hartley.

Mr. J. H. Brearley, of Longwood, then responded to the Chairman's call, and expressed his admiration for Mr. Hartley's lecture and the actual work it represented. While sitting there he had been conscious of many emotions, and perhaps chiefly of pride in the extent of the development in gas-fires during the past six years. Mr. Hartley had told them how that the Institution's Research on Gas-Fires was commenced here six years ago. Six months previous to that he had read a paper on gas-fires, at the Dublin meeting of the Institution of Gas Engineers, in which he had embodied the many tests he had made on various makes of stoves; and he felt some pride in remembering that the industry had been convinced that there was a great deal yet to be learned about the proper construction of gas-fires. The Institution appointed first Dr. Drugman and then Mr. E. W. Smith; and their work would ever be quoted in connection with the estimation of the radiation efficiency of gas-fires, and the problem of the complete and safe removal of their combustion products. They had been reminded that the radiation efficiency six years ago was but 32 per cent., while now—as could be seen from Mr. Hartley's figures, and from other recent tests which gave even higher efficiencies—that was nearly doubled. They must all drive the fact home upon themselves, and then upon their gas consumers, that without any change of the price of gas, gas-fires were only half as costly in use as they were six years ago, since a doubled radiation percentage had been attained. He entirely agreed that it was

possible to construct canopies that did prevent the products of combustion leaking out into the room. When he was carrying out his investigations (and he devoted over 2000 hours to it before he began writing his paper) no fire that he examined was free from the improper escape of these products of combustion. He rejoiced in the present insistence on stoves fulfilling the requirement of being able to carry off properly their waste gases, and he was convinced (and Mr. Hartley's lecture had confirmed that view) that it was quite possible to realize this requirement and to accomplish it without any loss in radiation efficiency. When he did his tests, he had had to start from nothing. He only carried out seven tests on each fire, taking them on a horizontal semicircle. The Research Committee went further, and tested throughout a hemisphere. But it was obviously impossible for him to have carried out 81 such tests in each fire, and to have dovetailed all this work into the ordinary duties of an engineer's life. He was glad to find Mr. Hartley considered the Leeds method of testing—the radiometer and the thermopile readings combined—was the best and most reliable yet suggested. Professor Smith had written to him about the use of his radiometer, and he had placed the Leeds authorities in communication with Professor Smith. If a simpler test could be devised—one that could give quicker readings and yet be reliable—it would be a great boon. Mr. Bond was at the present time working at such a method; and he had every hope that in a few months they might hear something from him.

The vote of thanks was passed with great warmth; and in reply Mr. Hartley thanked the members for their patience and attention. He had been warned that it would be well for him not to go too fast or too high—at least in the spoken address—so it was all his fault if he had been too sudden in plunging them into the cosine law. Still he had had to skip much; but as he understood the full text of the written lecture would in due course be published, it would be possible for those interested in the matter to go further into it.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

A Meeting of the Association was held in the Royal Technical College, Glasgow, last Saturday week—Mr. JOHN WILSON, of Falkirk (the President), in the chair.

AWARDS.

Mr. D. FULTON (the Secretary) stated that the Adjudication Committee had agreed that the best paper read last session was that entitled "The Vertical Retort of the Shale Oil Industry," by Mr. G. F. M'Killop (Broxburn), and the second, "Gas for Heat, Power, and Light," by Mr. Thomas Carmichael (Dawsholm). The Committee stated that they had great difficulty in adjudicating between the papers; and they hoped the value of the prizes would be as close as possible.

THE VISIT TO LONDON.

The PRESIDENT said that he would like to remark on their extreme satisfaction in connection with their visit to London. The turn-out from the Scottish Association was, to say the least, admirable. Some thirty members attended at the gas exhibition; and it really said a great deal for the juniors when they went such a long way in such numbers, paying, as they did, the most of their expenses themselves. He further wished to express their thanks to the London and Southern Junior Association for the very kind way in which they received them, and the trouble they put themselves to in order that the visit might be made as enjoyable as possible. Personally, the visit was most enjoyable; and he knew he voiced the opinion of the others when he said so.

NOTES ON THE COMMERCIAL AND DISTRIBUTION SIDE OF A GAS UNDERTAKING.

Mr. JAMES B. STEWART (Glasgow) then read the paper on this subject which was published last week (p. 441). In the course of the discussion which followed,

Mr. G. H. M'COWAT (Glasgow) said the chief question here could not be settled generally, because it depended to a certain extent on whether a man was employed by a private or statutory company or a municipal undertaking. It was not a question of what London or Glasgow, or any other city, was doing. The only right course to take was to recognize that their problem was their own, and deal with it accordingly. Taking the strictest view (which he considered was the municipal), they began on the principle that every section of the concern must pay its share, and none lean for support on another. He would deal with a specific case—a concern with a big consumption. The large quantity involved would accentuate the difference, and show a decided preference one way or another. If they assumed that the company could manufacture and distribute 50 per cent. more gas in the year with its existing plant, if more constantly used throughout the year, let the output be 7000 millions, then 50 per cent. would be 3500 millions. Let them further assume that this additional quantity was used up by the gas-cooker suitable for the average family. It would take (say) 155,000 cookers and a corresponding number of five-light meters to deal with the quantity of gas mentioned in the year. If they estimated the cost of providing and fixing each cooker at £3, and each meter at 30s., it might be worked out in this way:—

	Per 1000 Feet.
Cost of coal, less residual products	2·33d.
Purification by lime, including labour, less residuals	5·32
Additional meter repairs	0·92
Additional cooker repairs	0·91
Interest, sinking fund, and depreciation on cost of additional cookers, based on 10 years' life	3·00
Do., do., for meters, based on approximate 17 years' life	1·50
Actual cost per 1000 cubic feet	13·98d.

The price charged for the gas in this particular case was 1s. 9½d. He did not care for the free policy, but preferred hire-purchase. He was also against the policy of maintenance in any shape or form. He looked upon anything tending to a monopoly as objectionable. It stifled competition, and prevented the healthy rivalry which was essential to progress and advancement in any permanent form. He would prefer to encourage the sale or use of gas by lowering the price and inducing consumption thereby. There was a great complaint about the insufficiency of gas appliances; but if a demand was created for them, they could not disregard it by remaining ignorant about the use and proper treatment of gas appliances, unless they wished to commit a sort of business suicide. If consumers could be induced to provide their own appliances, it would simplify a great many questions regarding the removal and enlargement of proprietors' fittings, and would thus relieve the revenue. The principal point to aim at was getting the price of gas per 1000 feet down to the lowest point; and everything affecting the revenue that was outside public obligations should be strictly scrutinized. Any expense in the shape of piping should be borne by the proper individuals, and should not be saddled on the general consumers. There was the agitation in favour of smoke abatement, which was no doubt a very laudable object; but consumers of gas should not be asked to contribute to any public improvement without some proper method being adopted to show at least what they were contributing. He advocated an advisory section in the distribution of gas. This staff could be employed in visiting consumers and inquiring after their interests and into the nature of complaints, and in advising them as to the proper method of using gas appliances. They could also call attention to new appliances, and invite them to witness demonstrations of these. The staff should be composed of specially informed men. The administrative section of the paper showed that Mr. Stewart had clearly-defined ideas about management.

Mr. D. FULTON (Helensburgh) said the author had given a complete description of the organization of the commercial and distribution departments of a very large undertaking; but he thought they ought to take him to task for confining his remarks to large works. In the majority of works in Scotland, the gas manager had bound up in himself the talents of all these specialists spoken about. In regard to free cookers, Mr. Stewart stood alone in the world; for it had been found to be an absolute fact that, where undertakings had adopted free cookers, they had been able to reduce the price of gas. The standing charges were the same, whether they made 17 or 70 millions; but with the larger quantity they could spread them over a greater number, at less per 1000 feet. They all knew most works made a much larger quantity of gas without very much increase in labour costs. If they made a charge for maintenance to the consumer, they would not get rid of the grumbles about the quality of gas; and the efficiency of the appliances was the very best advertisement of gas they could have. It was the small consumer who benefited from the free cooker. The reason why they should not give gas-fires free was because people would wish them put into rooms where they would likely be little used.

Mr. A. WYLIE (Glasgow) did not agree with Mr. Stewart that it was a bad business principle to supply, equip, and maintain appliances free of cost to consumers. People were always ready to take something for nothing. They could not free themselves from the fact that in all up-to-date undertakings it was an absolute necessity for them to give out these appliances free of charge, otherwise the advance could not have been maintained. The popularity of gas-cooking appliances at present was mainly due to the fact that they had been brought right into the lives and homes of the people under fair conditions; and he would advocate that similar conditions should be adopted as regarded other domestic appliances. Still, he appreciated Mr. Stewart's remarks with reference to the cost of gas at present, and the danger of the consumer reverting to coal for both heating and cooking. But he was of opinion that, if they continued to increase their consumption each year, and gave strict attention to the consumers' wants, the different undertakings would soon recover all losses brought about by the heavy expenditure in purchasing appliances, and the price of gas would be considerably reduced. By such means he was confident that the future of gas was assured. If appliances were hired-out at a fixed charge per annum, and the price of gas reduced thereby, the consumer who used gas only for lighting purposes would reap the benefit; while if no charge was made for the appliance the increased consumption would soon pay for all the extra outlay. He would like Mr. Stewart to inform him whether he had proved that the method of giving out free cookers was a failure. With regard to the outside staff advocated, he suggested that it should include a superintendent for the gas-fitting and maintenance departments. The booklet to be used by the district foremen was a splendid idea, and was already employed in a

number of gas undertakings. He did not think Mr. Stewart's single card system was practicable in large undertakings. If they had to serve 200 men with 21 different kinds of material for one job each day, did he mean the cards for each had to be taken out, marked, and replaced?

Mr. T. CARMICHAEL (Dalmarnock) expressed the opinion that if a separate charge was made for supervision and maintenance of gas appliances, very few would take advantage of it. Consumers would not pay any addition to their quarterly account, and the injury to appliances from neglect would become chronic. A large proportion of their business would then go to competitors. By adopting a system of free maintenance and charging for mantles and glassware, the cost per 1000 cubic feet would be comparatively small, and the satisfaction given would ensure the retention and extension of their business, and would recoup the outlay. Any expenditure in the shape of maintenance must be looked upon as the price of the insurance or protection of their business. The free-cooker policy had proved a huge success in quite a large number of big cities, and instead of prices going up, in spite of dearer coals, they had been steadily coming down. He was sorry Mr. Stewart had not given figures to prove that the price of gas must rise. The consumer in taking a cooker must guarantee an increased consumption over what the gas department thought his average yearly lighting account should be; and he felt sure that, with this policy, a substantial profit was made, after deducting interest, depreciation, and maintenance from the revenue of the increased consumption, while conferring a boon on the consumer. There was no doubt that a policy whereby beneficial results accrued both to consumers and gas departments was now being considered by all progressive undertakings; and a great effort was being made to satisfy consumers. If any expense was incurred thereby, it was the cost of the protection of business, which meant protection of price and dividends to companies.

Mr. J. S. M'NICOL (Dawsholm) argued that the maintenance department could not stand by itself, and was only regarded as a matter of convenience for the working of the business. He could not see how Mr. Stewart could stand to his opinion about free cookers if he took into consideration the big trade by gas undertakings in Scotland in connection with these free appliances.

Mr. JAMES GRANT (Glasgow) said they must all greatly admire Mr. Stewart's courage in tackling such a question, in spite of the opinion held by almost everybody in the gas concern. It was not the case that the maintenance of gas-cookers told against the small consumers. In Glasgow it was well known that often the smallest consumers were supplied, not only with a slot-meter free of charge and without leaving a deposit as the ordinary meter user had to do, but with a small grill; and if they came in contact with these people, they would find they had no intention of reverting to coal. He did not think, even supposing gas had gone up in price a little lately, that the people would ever go back to the coal-fire instead of these gas appliances. He could not see eye to eye with Mr. Stewart in regard to the apprentice question. Mr. Stewart was well aware that all large undertakings were faced with a difficulty in regard to this very point. Gas-fitters, plumbers, and tinsmiths were all up in arms against apprentices serving their apprenticeship in a shop where there was only one class of work. In the trade he belonged to, there were certain branches in which the apprentices were only allowed to remain two years; and then they had to change. This was for the benefit of the young men, so that they would have a fair opportunity of learning their trade properly. He did not think it would be a good thing for a gas concern to bring up apprentices to pass direct into the workshops.

Mr. W. SHEPHERD (Glasgow) said he had heard a good deal about free cookers which surprised him, because people were paying for their cookers all the time. It was a matter of indirect taxation. It was a very open question whether it would be ultimately a gain to the gas industry to give out and maintain cookers free. He did not think that, once the people got into the habit of using gas, they would go back to coal.

Mr. JAMES M'GHEE said Mr. Stewart was like a "voice crying in the wilderness." As Mr. Shepherd had remarked, there were no such things as free appliances. He quite recognized the difficulty Mr. Stewart had in dealing with this paper. Being attached to a large gas undertaking, possibly without thinking, he had Glasgow in his mind all the time. But they had a number of small undertakings in the country in which all the various officials were rolled into one. In Glasgow, prior to the advent of the so-called free cooker a little over two years ago, the revenue rental from these cookers was £10,000—equivalent to something less than ½d. per 1000 cubic feet. On the abolition of the rental, the number of cookers, in the short period of two years, had increased to a greater extent than in the previous twenty years. The consumption had also gone up, though it was difficult to put it down definitely, owing to the absence of any method of checking. But those who were able to read between the lines said the increase in cookers was the chief cause of the increased consumption. It was said that the same argument should apply to gas-fires. He could not really say it should, for the reason that, while it might ultimately do so, he thought it was necessary to put a rental on gas-fires to keep them from going out in such numbers. Otherwise a great many would have them simply because they were going free, and would not be increasing the consumption in the same proportion. This consideration quite justified the gas department in putting on a rental for fires. Dealing with the matter of apprentices, Mr. Stewart had touched on what was a thorny question. He quite agreed with the idea of rearing their own apprentices. He had had experience of plumbers who had actually confessed that they did not know anything about a bunsen burner. He maintained that they should educate and bring-up properly trained men to deal with all classes of gas-fittings. He was also in favour of having inspectors of mains who were experts, and who also had a good knowledge of electrical appliances.

Mr. A. WRIGHT (Lockerbie) spoke in favour of gas undertakings training their own fitters and giving them a knowledge of all the fittings. It would assist small gas undertakings, because these men, when they went out, could educate consumers in the use of all gas appliances.

Mr. ALEX. WILSON (Glasgow) said he had been mainly responsible for free cookers being adopted in Glasgow. His reason for advocating this policy was that, when he took charge of the business, the rates for cooking appliances were rather high, and the increase in their use was very slow—a few hundreds a year. They had been going for fifteen or twenty years before he took charge; and there were only a few thousands in use during that time. Talking it over with Mr. M'Ghee and some others, they came to the conclusion that if they wanted to get cookers adopted more largely, they would have to make it easier for the people to get them, because the great bulk of them felt they could not pay the hire rates. They reduced these rates very considerably, and the cookers began to go out; and when they reduced the rates further, the numbers rose very considerably—to thousands a year, where they had been having hundreds. Then they reached the point when they had the hire rates taken off; and now they had 170,000 odd out. This told its own tale; they had induced the people to adopt them. But there was another side to the question which Mr. Stewart had brought out quite clearly. He said every part ought to bear its own share; and in looking at this point one was naturally inclined to think that was the right way of doing things. But if they considered it, the question of supplying gas for power purposes had been such that a cheaper rate ought to be given for gas so used, because the consumption took place all through the year. They did not require the same capital expenditure. The plant was the same, and in any case they needed nearly the same number of men, because when gas was used for lighting purposes it was chiefly in winter, and they required a very large staff. It was therefore only an act of justice to people using gas for power purposes that they should have the benefit of the lower price of production. The same question arose with regard to gas for manufacturing. If this was a right thing to do for gas for manufacturing and power purposes, he thought it was only an act of justice, if they could produce it at a lower rate, to extend the principle to the users of cooking appliances. Gas for cooking was mainly used in summer; and they found that there had been a great increase in the consumption in the summer months since the adoption of free cookers. They could thus give gas for cooking purposes very much cheaper than for power and manufacturing, because they employed plant and capital which would otherwise be lying idle. It was more an act of justice to give the benefit to those who used the gas for cooking than for manufacturing and power purposes. Some advocated what were called discount-meters; but in Glasgow they could not put a meter on every service and give a reduction in the price of gas and free cookers. The adoption of free cookers had resulted in materially reducing the price of gas to all.

Mr. MALCOLM LITTLEJOHN supported Mr. Stewart in his argument against free cookers. If they admitted free cookers, they must carry the argument to its logical conclusion, and give gas-engines free. He was in favour of putting on a discount meter in the case of gas for manufacturing and power purposes; and if people wanted cookers, let them pay the ordinary rate for them. He did not think the corporation should train their own apprentices. No outside firm would take an apprentice trained by a corporation. As regarded improvement among men themselves, this lay with the men. He did not think a young man wanting to improve himself would stay away from the technical college simply because his foreman was there. He would try and emulate his foreman, and surpass him if possible. He did not believe discussions among men would be any good. They would tend to rouse ill-feeling. At present, 75 per cent. of the workmen had practically no interest in their work.

Mr. A. WILSON added that, when he used the argument in favour of free cookers, he omitted to say that the same argument did not apply to gas-fires.

The PRESIDENT, after some complimentary remarks regarding the paper, said he felt sure Mr. Stewart, deep down in his heart, believed in free cookers. It was merely a question of policy. They all knew a commodity which was sold at 1s. per lb. overweight (instead of reducing the price by one-half, they increased the amount given by double). The gas department had done exactly the same thing in giving out free cookers. Instead of reducing the price of gas, they had given free cookers. He had no doubt the increased sale of gas would compare with the increased sale of the other commodity he referred to. It had been asked why, if they supplied free cookers, they should not also supply gas-engines free. His reply was that they gave a benefit to every individual family, because there was no family which should be without a gas-cooker; whereas if they supplied and equipped gas-engines free, they would be helping only a few individuals. In giving out free cookers, people were generally asked to sign a promise that they would keep the cooker in good condition, and that they would consume a certain amount of gas; but the form

was really of about as much value as the paper itself. It went for nothing. Now that the House Letting Act had come in, and there were so many monthly flitters, what were they going to do with the consumers who got a cooker and removed perhaps at the end of three months? They would require to make a charge for fixing the cooker; and if it was kept for a year, the deposit might be returned. Another great point was the apprentice question. Mr. Stewart was quite right in saying that gas corporations and companies should train their apprentices. They did not want to train apprentices to send them out to somebody else, but for their own use.

Mr. STEWART, in reply, remarked that there had been a good deal said in favour of free cookers, or what would seem to be in favour of them. The great difficulty with regard to the policy of free cookers was that they could not get figures to prove either one way or another. Now, 17,000 free cookers going out made a very big charge on depreciation. A 10 per cent. charge on revenue worked out to something like £12,000. The whole point was whether it would be better to cheapen the gas or give free appliances. It did not matter whether he spoke of large undertakings or not. What he wanted to see were thorough business principles. No department was too small to adopt up-to-date business methods. Mr. Fulton had said that free cookers had reduced the price of gas; but he had never seen figures in any journal to prove that the free cooker had reduced the price of gas. It was also a moot point whether the small consumer reaped the benefit. He did not think there was the difficulty in working the single card system which Mr. Wylie had spoken about. With regard to Mr. Grant's remarks about the apprentice question, he admitted that trades unions were not willing that the men should be trained in any shop where they could not get a general training; but the only shop where an apprentice could get a general training now was a very small repairing shop. Replying to Mr. A. Wilson, he said he was not dogmatic; but he would like to have it proved that free cookers were a better advertisement than cheaper gas.

Manchester Section of the Junior Institution of Engineers.

At a recent meeting at the Victoria Hotel, a local section of the Junior Institution of Engineers with Manchester as its centre was inaugurated. Mr. W. A. Tookey, a Vice-Chairman of the Institution, presided; and the London deputation included Mr. A. Clifford Swales, the Secretary. Others present were Mr. C. H. Prichard, who has been acting as Local Chairman, and Mr. F. G. Hatch, Hon. Secretary of the Section. Mr. Tookey said he thought there should be a branch with Manchester as its centre. The Institution was unique in that it embraced all engineers; and he claimed that membership would prove of great benefit to the individual. Finally, the proposition to send a requisition to the Council asking to be allowed to form a local section was carried *nem. con.* It was suggested that, as soon as the local funds permitted, the section should have a room and library of its own. Mr. Prichard was appointed Chairman, Mr. Maurice Hird Vice-Chairman, and Mr. Hatch Hon. Secretary—the latter appointment to be confirmed by the Committee.

"Gas and Oil Engines."—We have received from Messrs. Scott, Greenwood, and Son, of No. 8, Broadway, E.C., a little book bearing the above title. It contains a concise account of the most important types of the classes of engines named; and the text, which has 55 illustrations, is a translation and adaptation to English practice, by Mr. Charles Salter, of the original work by Herr Alfred Kirschke, Lecturer at the State and Municipal School of Handicrafts at Halle. The price of the book, which is one of the "Broadway Series of Engineering Handbooks," is 3s. net.

An American Gas-Scrubbing Apparatus.—Mr. E. F. Lloyd, of Detroit (Mich.), has taken out a patent for the United States (No. 1,073,259, of 1913) for gas-scrubbing apparatus. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," a vertical cylindrical casing, with a gas inlet at the lower end and an outlet at the top, is divided into compartments by horizontal annular partitions forming liquor troughs. A rotating shaft passes up through the centre of the casing, and carries a non-perforated plate in each compartment, with scoops for throwing the liquor upwards against the under sides of the partitions. An outwardly directed flange on each plate throws up the liquor, which is projected outwards by centrifugal force; and a depending flange on each partition directs the liquor back on to a perforated outer portion of the plate.

Analyses of United States Coals.—There has lately been issued by the United States Bureau of Mines a report entitled "Analyses of Coals in the United States, with Descriptions of Mine and Field Samples Collected between July 1, 1904, and June 30, 1910." It contains the analyses of 5000 samples of coal taken from 1500 mines and prospects; and practically all the more important mining districts are represented. The report is in two parts—one giving the methods used in collecting and analyzing the samples, with the results of the analyses; the other indicating the exact location from which each sample of coal was taken, with a description of the characteristic features of the coal bed at the point of sampling, the nominal capacity of the mine, and such notes on the preparation of the coal as might be useful to consumers. The particulars contained in these volumes are, we believe, unequalled in scope and value for comparative purposes by any others published in other coal-producing countries.

MIDLAND JUNIOR GAS ASSOCIATION.

Visit to the Coke-Ovens and Mond Gas Plant at Saltley.

On Saturday afternoon, some sixty members of the Association (headed by the President, Mr. W. H. Johns, of Malvern) assembled at the Saltley Gas-Works of the Birmingham Corporation, for the purpose of inspecting the sections of Koppers coke-oven and Mond gas plant both at work and in course of construction. The party proceeded first to the offices, where they were welcomed by Mr. W. Chaney, the Engineer of the works. They were then split up into parties; and under the guidance of Mr. Chaney, Mr. C. C. Barber (the Superintendent), and several assistants, a move was at once made to the coke-oven installation—the other portions of the works not being inspected. Much useful information was given to seekers after knowledge by Mr. E. W. Smith (the Chief Chemist to the Gas Department).

In view of the pioneer work which the Birmingham Gas Department are doing—so far as this country is concerned—in connection with the erection of a large installation of Koppers coke-ovens as part of their gas-making plant, a great deal of interest has been taken in the work; and the industry generally was under a debt of gratitude to Mr. Chaney for the paper relating to the plant which he read last June before the Institution of Gas Engineers. Since that time—indeed, as recently as a month ago (*ante*, p. 154)—Mr. Johns devoted the main portion of his Presidential Address to the Midland Junior Association to the same subject; and so the members arrived at Saltley on Saturday with the chief points about the installation fresh in their minds. The Mond gas plant in connection with the heating of the ovens was first visited; and here non-caking coal was seen unloaded into an electric lift, for use in the gas-producer. This and the twelve original ovens were inspected, and a charge of coal—which is technically termed a cake—was seen prepared for putting in the oven. The preparation of the disintegrated coal consists mainly in its compression by means of a self-reversing electro magnetic stamper. While the visitors were there, one of the ovens was discharged by the electrically operated ram, and the coke was seen quenched and screened by means of the Goodall coke-quencher, into which it was discharged. The operation of pushing the mass of red-hot coke from the oven on to the table of the quencher—the "joy-wheel," as it is familiarly termed at Saltley—was a fine sight as witnessed from the platform of the quencher in front of the oven, and was well worth the slight personal discomfort in the way of roasting and steaming which it entailed. The previously prepared charge was then placed in the oven.

After this an inspection was made of the whole of the extensions. These comprise 54 ovens, 35 feet long, 8 ft. 10 in. high, and 18 in. to 19½ in. wide; so that, when they are at work, there will be, with the 12 ovens already in use, 66 ovens in all. One battery of 28 ovens was seen to be nearing completion; while the remaining 26 ovens were in an advanced stage of construction. The visit was, in fact, excellently timed; for in addition to seeing the system at work, the members could make a careful examination of the internal arrangements. Four additional Mond gas producers have been erected (making five altogether), and are now practically ready for putting to work. In connection with the installation, there is to be an ammonia recovery plant, and the necessary apparatus for the efficient extraction of tar and dust.

After a couple of hours or so had been spent around the coke-oven plant, the party went to the Gas Department Recreation Room in Devon Street, which is only a few minutes' walk from the works. Here there was awaiting them an excellent tea, which had been kindly provided by Alderman J. H. Lloyd, the Chairman of the Works Sub-Committee. Mr. R. S. Hilton, the genial Secretary and General Manager of the Birmingham Gas Department presided; and those present included Dr. W. B. Davidson (Engineer of the Nechells works). This official recognition, with its implied faith in the good work which the Association are doing, is thoroughly appreciated by the members, who were afforded some opportunity of expressing their feelings before rising from the tables.

The PRESIDENT remarked that their thanks were due to the Birmingham Gas Committee for granting permission for the visit that afternoon. It had been exceptionally instructive to many of them, for, of course, it was not every day that those engaged in gas undertakings could inspect coke-ovens. At any rate, in that part of the country they were not favoured with them as was the case in the North. Birmingham was doing pioneer work in connection with the adaptation of coke-oven practice to gas-works. It had been thought for some time that the best and most economical way of making gas was by means of large units, by which, of course, the labour costs were considerably reduced. What they had just seen was an illustration of what he might call the last word in gas-works carbonization; and he believed that, when the full installation was at work, there would not be anything to touch it for labour charges. In addition to this, the metallurgical coke produced commanded a higher price than ordinary gas coke; and as the Birmingham Gas Department were situated in the midst of country which abounded in works requiring such coke, the demand warranted them in introducing the system, apart from all other considerations which no doubt the General Manager and Engineer had in mind at the time. Some of them who were engaged in country gas-works realized at present the difficulty of disposing of ordinary gas coke; and any such system as this tended to ease the market somewhat. They were therefore obliged to those of the larger undertakings which might assist them in this way. They had seen what a lot

of work had been done at Saltley, and how much still remained to be done before the installation was completed. Really, this was a fortunate thing for them; for they had seen a section at work, a section nearly finished, and a section in course of construction. He proposed a hearty vote of thanks to the Gas Committee for allowing them to visit the works, to Alderman Lloyd for so kindly providing tea, and to Mr. Chaney and his assistants for the trouble they had taken in showing them round and explaining everything to them.

Mr. F. J. WARD (the Senior Vice-President), in seconding, agreed that the visit had been a highly instructive one, and that it was a good thing to see in operation systems which would assist in taking some of the ordinary gas coke off the market. When the complete installation was at work, it would, he was sure, prove beneficial to the Birmingham Corporation.

Mr. CHANEY, after the vote had been heartily carried, returned thanks on behalf of the Gas Committee. He said that the Committee, when they heard that the Association were desirous of visiting Saltley, immediately acquiesced, and Alderman Lloyd was only too pleased to have the opportunity of entertaining them. Personally, he felt obliged to the members for visiting the works, and sincerely hoped the afternoon had been profitably spent. If this was the case, he would be amply repaid, and so would his assistants, for anything they had done in showing the members round. What the Birmingham Corporation were doing in putting down coke-ovens was, of course, rather a unique thing in connection with gas-works in this country, where (unlike what was the case on the Continent) the illuminating power of the gas was the bug-bear. As long as they had to make gas of a high illuminating power, coke-ovens and other modern systems had not such a good chance as they otherwise would have. It was somewhat of a venture to set out to make high illuminating power gas with coke-ovens; but they were hoping to be able to so combine illuminating power and calorific power as to supply something equally as good as was at present obtained from the ordinary retorts. There was really no question of coke-ovens competing with vertical retorts. There was only a market for a certain amount of the special coke produced; and so long as the collieries continued to put down so many coke-ovens, there was no fear of plant of this nature entering into competition for gas-works with the ordinary gas-works plant.

Mr. T. BERRIDGE proposed a hearty vote of thanks to Mr. Hilton for presiding at the tea, and for the great interest he always showed in the affairs of the Association. Speaking for himself, he had enjoyed the visit very much indeed, and felt grateful to Mr. Chaney and his assistants for all the explanations of the plant they had vouchsafed. Alderman Lloyd's hospitality was also very welcome. He had often heard of Alderman Lloyd's work in connection with adult schools; and he could not imagine a better work, or one that would be of more benefit to the country at large. Always would he honour Alderman Lloyd for the work he was doing in this direction. As to Mr. Hilton, he frequently met him in connection with the British Commercial Gas Association—an organization which was doing a grand work. Mr. Hilton took very great interest in his assistants, and all those who were associated with him in the Birmingham Gas Department. In fact, he had certainly been quite an asset to the gas profession generally in the Midlands since he entered it.

Dr. DAVIDSON, who seconded, remarked that, as the Secretary and General Manager of such a large concern as the Birmingham Gas Department, Mr. Hilton's time was precious; and the wonder was how he found it possible to attend so many meetings and take the interest he did in educational and other matters. He supported those connected with the department both in their studies and in their amusements.

The vote was passed with acclamation, and to the accompaniment of "For he is a jolly good fellow."

Mr. HILTON, responding, expressed his pleasure at being with them. Referring to what they had seen at Saltley, he remarked that this question of coke-ovens appeared to him to be as much a commercial problem as an engineering one. With this coke-oven business they secured a new asset, inasmuch as they were enabled to enter a market with their coke from which they were hitherto debarred. This was a very important thing for a big gas undertaking. The problem of coke distribution was a difficulty which would have to be overcome before they would all find themselves in the position they would like to occupy; and anything which tended to open up fresh markets, as this new system would do, would be all to the good. He was glad Mr. Johns and Mr. Ward regarded the Birmingham Gas Committee as benefactors, in so much as they were going to take some of the ordinary gas coke off the market. In Birmingham, they did their best to develop the local trade; and he regarded it as everybody's duty to do this, and push their sales of gas coke for themselves. The Committee would be very happy indeed, and so he was sure would Mr. Chaney, if the members visited the coke-oven installation again when it was completed and fully at work.

This brought to a close an outing which had given pleasure to all who took part in it. On the works, of course, the only subject to which attention was given was the coke-oven installation; but the tea, and a game of billiards afterwards in the recreation room, afforded opportunity for the comparing of notes. In the course of conversation, it was a pleasure to learn, from managers in several different places, that the recent National Gas Exhibition and the Ideal Home Exhibition have had a very beneficial effect on business.

According to the returns published by the United States Geological Survey, the quantity of briquetted fuel manufactured in that country in 1912, at 19 plants, was 220,064 net tons (2000 lbs.), valued at $952,261, compared with 218,443 net tons, valued at $808,721 in 1911. Of these plants seven used anthracite culm, nine used bituminous or semi-bituminous slack, one used residue from gas manufactured from oil, one used mixed anthracite culm and bituminous slack, and one used peat.

THE MELTING POINT OF COAL ASH.

Dr. E. J. Constam, Professor of the Technology of Fuel at Zürich, read a paper on "The Melting Point of Coal Ash" at the fortieth annual general meeting of the Swiss Association of Gas and Water Engineers, which was held at Berne on the 6th to 8th of September last. The following is a summary of the contents of the paper, taken from the report of the proceedings of the meeting in the "Zeitschrift des Vereines der Gas- und Wasserfachmänner in Oesterreich-Ungarn" of Oct. 15.

Professor Constam stated that, in view of the importance attaching to the behaviour of coal ash in furnaces, and in particular its bearing on the use and value of coke, he had devised a special apparatus for determining the fusing point of ash. He heated in an electric furnace a tube closed at one end, into which the ash was introduced in the shape of an equilateral pyramid. These pyramids were obtained by making the ash into a paste, moulding it in the shape, and drying. On heating, the decrepitation, intumescing, and fusion of the pyramids of ash, and the temperature of fusion, could be optically observed, as the tube, closed at one end, had the properties of an absolutely black body. About 200 different samples of coal and coke ash had been examined with the apparatus, and the results tabulated.

The ash consists, according to its origin, of the following constituents—viz., (*a*) the mineral substance of plants from which the coal has been formed; (*b*) mineral admixtures which have been introduced during the deposition of the plant or vegetable matter; (*c*) mineral matter which has been raised with the coal in winning it from the pit; and (*d*) matter which has become mixed with the coal in transport or in use. Constituents (*a*) and (*b*) are characteristic of the origin or of a particular seam, while (*c*) and (*d*) can be diminished by taking suitable precautions. It becomes a question therefore of determining whether the melting point is a constant depending upon the description of coal, or, in other words, is determined by the nature of the coal substance. The author is of opinion that the investigations so far carried out do not admit of this question being answered definitely, but it appears that: (1) the quantity of ash has no influence on its melting point; (2) the melting point of the ash is a characteristic of the seam; and (3) the melting point of coal ash is in general not affected by coking and the temperature of coking. The investigations gave melting points ranging from 1150° to 1700° C. (2100° to 3090° Fahr.), and the author classifies coal ash into the following groups—viz., (1) readily fusible—below 1200° C.; (2) fusible—between 1200° and 1350° C.; (3) difficultly fusible—between 1350° and 1500° C.; (4) very difficultly fusible—between 1500° and 1650° C.; and (5) refractory—above 1650° C.

Chemical analysis showed that, as regards the samples examined, lime, iron, and sulphur (pyrites) lowered the melting point, while alumina raised it. Therefore if an ash has been found to be too readily fusible, the addition of alumina or clay, or the admixture of the coal with another coal having a difficultly fusible ash, should serve to give an ash having the required fusing point. It is shown that it is necessary also to pay greater attention to the amount of slate in the coal; for, though slate is generally refractory, it becomes the core of large lumps of clinker which interfere with the working of the furnaces.

With regard to the uses of coal, the following limits for the melting point of the ash are named—viz., coke for central-heating plant, above 1300° C.; anthracite for central-heating plant, above 1400° C.; boiler coal, above 1400° C.; locomotive and producer coal, above 1500° C., or fluxing at about 1200° C. Gas coal should therefore have ash with a fusing point not below 1300° C., and should be as free as possible from pyrites and slate. The author is of opinion that the determination of the melting point of the ash will become an important criterion, like the determination of volatile matter and of the proportion of ash, in the valuation of coals, especially gas coals.

REFRACTORY MATERIALS.

Two series of lectures for the 1913-14 session have been arranged by Mr. J. Stuart Ker, the principal of the London County Council Westminster Technical Institute, for those engaged in the gas industry, with the object of placing before them the latest practice. One of these courses is to consist of three lectures by Dr. Rudolf Lessing on "Refractory Materials;" and the first of them was delivered by him at the Institute, in Vincent Square, on Friday evening last. The audience numbered 65; and the evening was generally voted to have been a highly profitable one to the listeners. The subject was illustrated by a table full of models, as well as a dozen or so lantern slides.

Having begun at the beginning, by referring to the definition of refractory material, the lecturer proceeded to consider the question of the supply of these materials, the principal of which are fireclay, silica material, bauxite, magnesite, chrome, and certain other oxides. The chemical composition of these was gone into, as well as their sources. The origin of clay was explained in detail, and the process of the secondary decomposition (kaolinization) of igneous rocks, of which clays are a product. The resulting pure clay substance (kaolinite) and its properties next received atten-

tion, and Dr. Lessing then went on to deal with the procedure of china clay (representative of the purest clay) mining in Cornwall; the difference of fire-clays from china clays, on the one hand, and potting clays on the other; the relation of alumina to silica in pure clay substances, and the influence of their ratio on the refractoriness of clays; the influence of fluxing impurities; and the law discovered by Richter, that impurities have the same fluxing effect according to their molecular equivalent.

The physical property of clays which is of importance from the point of view of the maker is the plasticity, as it affords the means of forming the raw material into the required shapes. Therefore the theories explaining the phenomenon of plasticity found a place in the lecture; and the degree of plasticity possessed by the various kinds of clays was pointed out, as well as the relation of plasticity to shrinkage and the contraction on drying. The residual contraction of the manufactured goods was also explained, and the difference of silica from clays with regard to these physical properties. Silica is non-plastic, and special binding material has to be employed for giving it the required shape. It does not shrink, but expands on heating, in consequence of changing its crystallographic structure.

Then Dr. Lessing went on to altogether a different branch of the subject—the actual treatment of fire-clays. He began with the mining, and spoke of the clay deposits in this country—more particularly in the Stourbridge district, Yorkshire, and Scotland. Slides were exhibited depicting the underground working, and then the fact was drawn attention to of clays being mined together with the coal which is used in the manufacture of the goods. The other matters explained included the process of weathering and its influence on the composition of the clay, the partial removal of fluxes, and the increase in plasticity, the preparing of the green clay for manufacture, the functions of grog, and its manufacture from the green clay. The difference in practice which exists between Continental and British works, it was remarked, is necessitated by the difference in the conditions of supply of raw materials, quality and quantity of grog, &c. On the Continent, a very much larger quantity of grog is put in. The binding clay they use is more highly plastic, and so will carry more grog. In this country, on the other hand, owing to the lack of a supply of seggers from porcelain works, which are used on the Continent for the purpose, clay from the pit has to be used for making grog, and the same clay as a binder. This being the case, the binder does not act so well as a binder as the Continental one. It is necessary to use more of it, and therefore less grog. The lecturer then went on to deal with the preparation of the mixtures, the mixing and grinding machinery, the tempering of the mixtures and maturing the tempered mixture (for which, in Continental practice, sometimes several months are allowed for the best quality material), moulding by hand and by machinery, and brick presses.

After the lecture, Dr. Lessing explained the exhibits—particular attention being drawn to the specimens representing unburnt retort mixtures, which had been separated into their constituents by the lecturer's own method, which permits of a comparison of various makes. These proved highly interesting. Sections of bricks and retorts were also shown, and the different points about them were emphasized.

Fatal Accident.—Last Tuesday, a labourer, named Frederick Soper, had an accident at the Buckie Gas-Works, which unfortunately had a fatal termination. Soper, along with a fellow-workman, was engaged in a trench, sinking a large drip-box, when part of the wall of the purifier-house, in which they were working, collapsed. The unfortunate man, in attempting to get clear, was caught among the *débris*. He was extricated, and it was found he had three ribs broken, and was suffering from other injuries, to which he succumbed the following morning. Soper, who was in the employment of Messrs. Willey and Co., leaves a widow and two children.

The Value of a Show-Room.—Mr. H. R. Cooper, on behalf of the Local Government Board, last Thursday held a formal inquiry at Elland, with reference to the Council's application for sanction to borrow £1000 for the purposes of their electricity undertaking. After the Inspector had been informed that there was a deficit on the electricity undertaking at the beginning of the year of £629, the application was amended from one for £1000 to £1500. The estimated expenditure for the next three years, it was reported, was £950; the amount on mains being £500, on service £250, and on meters £200. It was pointed out to the Inspector by the Chairman of the Electricity Committee that the Council had a powerful Gas Company to fight, who had a show-room—a feature the Council had not power to provide. The Inspector expressed the opinion that people who had a show-room found it commercially beneficial.

The Public Lighting Question at Ruislip-Northwood.—The remarks on this subject which appeared in the "Electricity Supply Memoranda" in the "JOURNAL" for the 28th ult. are reproduced in the current number of the "Sanitary Record and Municipal Engineering." Appended to them is an editorial note to the effect that the application to the Local Government Board for a loan for the public lamps had been withdrawn on the ground that "fresh information" had been obtained. Our contemporary is pleased to learn that, as a result of the "fresh information," and the public attention which has been drawn to the transaction, the Highways and Lighting Committee of the District Council at their last meeting decided to recommend that fresh tenders should be obtained, and that the new specification is not to discriminate in favour of the Electric Light Company, but each Company is to tender for the supply of light to the same candle-power lamp.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Progress of Gas for Lighting Purposes.

SIR,—I notice in this week's issue of the "JOURNAL" that a statement which I made at Barnsley has brought me under the ban of your editorial displeasure. Unpleasant truths are generally less palatable than comforting misrepresentations.

I can assure you that it was in no spirit of pessimism that I expressed the opinion that gas for lighting purposes was practically at a standstill, because I have the greatest faith in our industry going ahead, if the enterprise which you deem to be dormant in my case is prosecuted with the vigour and discrimination which modern requirements demand.

It is no use blinking the fact—at any rate so far as Manchester is concerned—that all, or nearly all, new residential property is fitted with electric light; and, however much one may deplore the fact, it is useless to pretend that the increase in consumption (which in the case of Manchester is nearly 5 per cent. for the half year) is due in any appreciable measure to the lighting consumer.

The Gas Committee of Manchester have never been lacking in their desire to popularize the use of gas for all purposes; and it is no doubt owing to the enterprise of its members that the department is in such a happy position as to be able to view with equanimity the steady growth of its lighting rival.

G. W. TOOLEY.

Rochdale Road Gas-Works, Manchester,
Nov. 6, 1913.

The Control of Heats in Regenerator Furnaces.

SIR,—With reference to "Works Engineer's" inquiry in his interesting article on "Improving the Fuel Account," I believe it is a common experience that increase of secondary air has caused improvement in the heats. But it is not clear from his article if the cases he has noted occurred under perfect conditions with regard to regenerators, draught, and regularity of heats.

In the cases which have come under the writer's observation, when working with sound regenerators and suitable pressures, the increase observed in the temperature of the retorts has invariably been at the expense of regularity.

It would be interesting to know from where the samples of waste gases were taken in the cases he has known. It is misleading to take a sample for analysis from the damper-flue, owing to short-circuiting of the secondary air. It is much better in the writer's opinion to preface a campaign against the fuel account by making analyses of samples taken from each waste-gas flue, from the damper to the inlet of the combustion-chamber. This will often give surprising results in regenerators thought to be sound. Where there is serious short-circuiting through inaccessible open joints in badly-designed regenerators, it is best to bye-pass the leaky flues—fixing the air-slide in the flue immediately above the leaky ones, until such time as they can be properly repaired or remodelled. The control of the heats thus obtained is worth some sacrifice in the regeneration.

Cases where the first three waste-gas flues have been the hottest part of the setting are not unknown. In these cases, as "Works Engineer" states, it is no use opening the dampers. Better close them, and open the air-slides, or, as a last resort, bye-pass the leaky flues as mentioned above. A slight pressure maintained under the crown of the setting will often assist in remedying uneven heats.

The writer is pleased to note that "Works Engineer's" interesting article is to be continued.

J. H. DARRAH.

Bramhall, Cheshire, Nov. 5, 1913.

The Tests of the "Sola" Gas-Fire.

SIR,—I was profoundly interested when I first of all read the claim of Messrs. Wilsons and Mathiesons for their new "Sola" gas-fire, backed as it was by so high an authority as Mr. John Bond, of Southport.

The meaning which you evidently took from this certificate, and which I fancy many of the interested trade would take from it, is that the firm had succeeded in delivering into the room, as radiant heat, 73·1 per cent. of the total heat units in the gas consumed.

On carefully reading the certificate again, however, I find that it might bear another construction—namely, that the flue-loss in each case had been entirely ignored; and that what the new fire had accomplished was to reverse the ratio of radiant and convected heat from 51 and 49 in the 1912 fires to 73·1 and 26·9 respectively in the 1913 fires. This would, of course, be quite a remarkable performance.

If this is what is meant, however, I am sure the firm have only to be made aware of the misconstruction on the part of your readers to make a public disclaimer. On the other hand, if they do claim to give as radiant heat 73·1 per cent. of the total heat units in the gas, they cannot make their claim too explicit, as their most aggressive rivals up to the present have only claimed some 60 per cent.

HENRY S. VALENTINE.

Stirling, Nov. 3, 1913.

Gas Water-Heaters.

SIR,—In your reports on the recent conference of the British Commercial Gas Association, there is one on a paper on heating water by gas. It seems to me to be very vague and lacking in any new information—especially in connection with running costs day by day. It is true there is a comment by a maker of gas-boilers, on certain tests carried out by him; but it is hardly necessary to say that such tests are no real guide to the daily cost in the average household.

For instance, can the thermostat be guaranteed to work with full

efficiency for (say) twelve months without attention, and can the cleaning be easily done by the average local fitter?

It is, of course, necessary to have this cleaning done regularly—at intervals determined by the nature of the water—or the gas efficiency is soon lowered. Is there any soot deposit from the non-atmospheric flames, due to variation in gas pressure during the day (this may be a very large range), or other causes?

I am not a believer in gas for this service, except where cost is quite a secondary consideration, and regard the ideal arrangement as gas for cooking and a coke burning boiler for hot-water supply. In my household of five persons and one child, using about four baths a day, the fire is lit about 7 a.m. and a hot bath can be had in 30 to 40 minutes. The fire is kept going all day for kitchen and general purposes, including washing-up after late dinner, and is then allowed to burn out. Sometimes on Sunday the fire would be let out in the afternoon. During slack hours, a lot of refuse can be burnt; and in winter ashes from the other room and nursery fires are put on. Firewood is used for lighting, or wood packing cases can be burnt up, with a few pieces of coal; but afterwards only coke is burnt. My coke bill averaged 1s. 3d. per week; sometimes two sacks of coke lasted a day or two over the fortnight. Can gas come anywhere near this for working cost?

There is not much dirt or dust with coke; and there are no flues to clean as in a range. Periodical cleaning is a familiar job anywhere; and where the boiler has to be fixed in the kitchen (as in my case) the heat is not great; while, if necessary, the boiler can be coated with non-conducting cement.

Nov. 7, 1913. P. B.

Coke Dust and Gardening Operations.

SIR,—The utilization of coke dust has been a problem to many gas undertakings. Some have tried making it into briquettes; others have tried mixing it with coal and re-carbonizing it; others, again, have used it for concrete purposes in various ways. Still another use can be named.

I find several amateur gardeners who appreciate the benefits of coke dust for lightening heavy soil. The mixture is necessarily determined by the nature of the soil. With heavy clayey soil, probably half coke dust and half soil is necessary. The effects of the mixture are best realized after being a couple of years in use, when an artificial manure can be added with considerable advantage.

Thinking the use of coke dust in the foregoing way may have escaped the notice of some of your readers, I venture to name it.

Huddersfield, Nov. 4, 1913. EDWARD A. HARMAN.

The Duties of a Rental Clerk and Book-keeper.

SIR,—I am sure there must be others like myself astonished at the definition of the vacant post after reading the advertisement No. 5809 in your issue of the 4th inst.

I am perfectly well aware that the rental clerk's duties in some gas companies' offices would not be sufficient to employ the whole of his time in that direction, but I think it is carrying the point a bit too far to add all the other clerical work of a gas company's office—from secretary to office boy—and in return style him as the advertisement does.

What does the secretary do, as, of course, it is not mentioned in the list of duties to be performed by the rental clerk, &c.? So no doubt the former clears out the offices and runs errands for the manager.

Might I ask the manager of this particular company how he would like to be asked to undertake managerial duties and in return be called a foreman fitter, &c.?

I wish the successful candidate joy in serving a personage with such a queer conception of etiquette in these circumstances.

Nov. 8, 1913. DISGUSTED.

Corrosion of Steel Water-Mains.

SIR,—My attention is drawn to the Mannesmann Company's reply [*ante*, p. 359] to my letter, *re* corrosion of steel water-mains.

Your correspondent would have us draw a distinction between coating and wrapping—inferring that simple coating is not a sufficient protection for steel against corrosion, and that it was the failure of the coating that provoked the destructive corrosion of the Goldfields steel main. The superiority he claims for steel therefore lies in the wrapping; and reliance is shifted from the material of the pipe to its protective covering. That is our view. There is nothing between you and destruction but a film of jute and a bituminous mixture, and this upon piping that will be exposed to the sun and weather or to the soil and moisture.

Now, what we contend for cast-iron piping is that, even without coating or wrapping, it is practically indestructible. It has lasted in that best-known instance at Versailles for 250 years; and in some of our oldest British works it has been installed for 80 years and more. The deterioration by rust is so slight that the pipes are in perfect service to-day. Some of them occasionally require to be cleaned out and freed from incrustation and the usual growth; but this can be done freely and without injury.

We note your correspondent now admits that there certainly was internal corrosion in the Australian mains, and that it was due to air in the pipes. There is always air in the pipes; and, as coating is not sufficient protection for steel piping, by his own admission, it will always be subject to the destructive corrosion of air by the subtle and uncontrollable electro-chemical natural processes so familiar in places where wrought-iron and steel are subject to the influences of air, moisture, change of temperature, and even the slightest acidity.

A case where cast-iron and steel are laid together in precisely similar conditions is found at the Tay Bridge, where the steel pipes ¼ inch thick have been corroded through from the inside, and the cast-iron pipes at either end of the steel section, laid at the same time and without any special protection, are in a perfectly good condition. Here is a comparison, to use your correspondent's words, "of real value."

THE HOLWELL IRON COMPANY, LIMITED,
THOS. SARSON, General Manager.

Asfordby, Melton Mowbray, Nov. 4, 1913.

A shareholder in several gas companies, alluding to the article by "R. W. E." in last week's "JOURNAL," "Thoughts, After Guildhall and Shepherd's Bush," writes congratulating him upon the insistency with which he presses his views, which, if realized, would, he points out, work wonders both for gas users and shareholders. The letter continues: "I have gas-fires in all rooms, and can vouch for the truth of his statement, for more gas is consumed in my dining-room fire than in all the bedrooms; and if it were delivered at a low price, as it could be, with a considerably increased production and lower capital charges, it would be in such general use for heating and cooking that it might be possible to supply a suitable gaseous fuel nearer to the Sheffield price. As a shareholder, I take considerable interest in these matters."

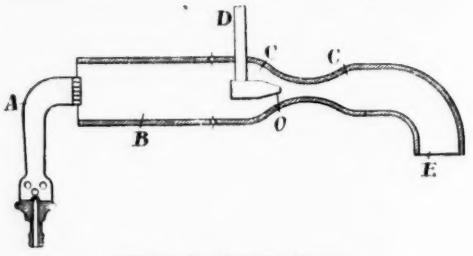
REGISTER OF PATENTS.

Heating Liquids by Combustible Gas.

MÉKER, G. A. H., of Levallois-Perret, France.

No. 23,523; Oct. 15, 1912. Convention date, Oct. 16, 1911.

This invention consists of an injector with a convergent-divergent casing through which the water to be heated is projected from a single central nozzle; the injector being preferably connected to the burner by a cylindrical extension for the purpose of intensifying the injector action. "Thus the gases of combustion and the pulverized liquid are respectively cooled and heated by one another."



Méker's Gas Injector Burner.

A is a gas-burner of any suitable type, preferably one "producing total combustion." The flame is directed into a cylinder B, of metal or refractory earth. At the end of the cylinder is an ejector C, comprising a duct D for the supply of liquid under pressure and the arrangement of double truncated cones usual in injector apparatus. The liquid issues at O through a single central calibrated orifice, and is there surrounded by, and comes into intimate contact with, the actual flame. The mixture of liquid and burnt gases passes out at E at uniform temperature.

Controlling the Lighting and Extinguishing of Gas-Lamps.

KENT-JOHNSTON, A. G., of Balham, S.W.

No. 24,772; Oct. 29, 1912. No. 25,282; Nov. 4, 1912.

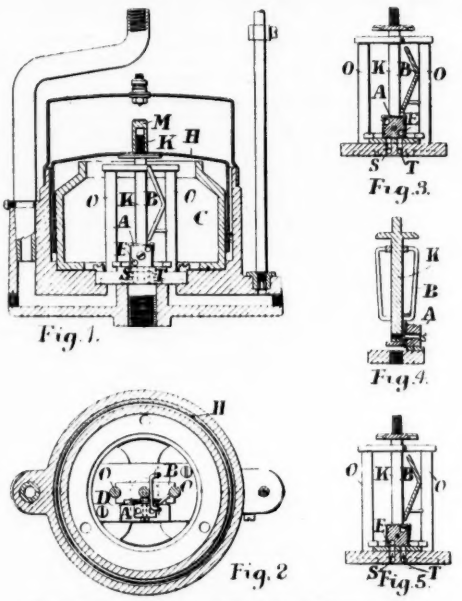
This combined invention relates particularly to apparatus for controlling the lighting and extinguishing of gas-lamps, of the type in which a bell or diaphragm is moved by an increase of the pressure in the mains, and by such movement causes gas to be supplied simultaneously to a main burner and a bye-pass burner, and thereafter to one or neither. The object aimed at is to provide apparatus which, owing to elimination of friction, shall be operable by a much lower pressure increase than has hitherto been usual.

The inlets to both burners terminate in the seating of a valve, the movable member of which contains passages permitting gas to pass to one of the burners when certain parts of the member contact with the seating, and is lifted off its seating during the movement of the bell or diaphragm, and thereupon partially rotated in order to effect the lighting or extinguishing on its return to the seating.

Figs. 1 and 2 show sectional views of the apparatus. Figs. 3 and 4 show views of the valve mechanism in figs. 1 and 2. Fig. 5 is a similar view to fig. 3, showing the valve member in a different position.

The operation of the apparatus is as follows: Assuming that the valve member A is in the position shown in fig. 3, gas cannot pass from the chamber C since both the passages S and T are closed. If, therefore, the gas pressure is increased, the bell H will rise, lifting also the spindle K and the valve member. In this way the member will be brought into contact with the loosely hung loop B, which will engage one of the teeth of the ratchet D, and, as the upward movement of the spindle is continued, will cause the valve member A to turn through an angle of 90°. If the rise of the bell were too rapid, it might happen that the valve member would be turned through an angle greater than 90°. This, however, is prevented by the member, if tending to turn more than 90°, coming into contact with a pin extending from one of the uprights O. If desired, a loosely hung member may be provided on the opposite side of the spindle to bear against the side face of the valve member, and by its weight also act to adjust the valve member. When the pressure is released, the bell falls, and the valve falls on to its seating, in the position shown in fig. 5.

It will be seen that during the upward and downward movement of



Kent-Johnston's Lamp Lighter and Extinguisher.

the bell both of the passages S and T were uncovered; and gas was therefore passing to both the bye-pass and the main burners. At the same time contact was made between the cap M and the terminal at the top of the casing, and the gas issuing from the bye-pass burner would be ignited either by the action of (say) an electric or electro-catalytic igniter. The flame of the bye-pass burner would then ignite the main burner. When the bell has fallen and the valve member, as explained, has taken the position shown in fig. 5, gas can still pass by the hole E in the valve member to the passage S, and thus to the main burner. The passage T, through which gas passes to the bye-pass burner, is, however, closed. Thus the main burner continues alight while the bye-pass burner has been extinguished. When the next increase of pressure occurs in the mains, the bell will rise and again allow gas to pass to the bye-pass burner, which will become ignited. During the movement of the bell, however, the valve member A is again rotated through 90°, and on the fall of the bell assumes a position similar to that shown in fig. 3, except that the valve member has been rotated through 180°, thus causing the holes in it to occupy the opposite positions to those shown in fig. 3. In this position of the valve member A no gas can pass either to the main burner or to the bye-pass burner. The next two upward movements of the bell cause the valve member to be moved through 90° each time, and thus cause the cycle of operations to be repeated. At the end of four movements of the bell the valve member has been moved through 360°, and has performed its cycle of operations twice in this complete rotation.

Heating or Lighting Apparatus.

FORRESTER, H. J. C.; a communication from the Rector Gas-Lamp Company, of New York.

No. 25,313; Nov. 5, 1912.

This apparatus comprises "one or more enclosed lamps or heaters of the bunsen type, an exhaust pipe connected to the means enclosing the lamps or heaters, and a rarefaction apparatus connected to the exhaust pipe to draw the air supply into and through the bunsen mixing tubes, and at the same time to extract the products of combustion from the exhaust pipe."

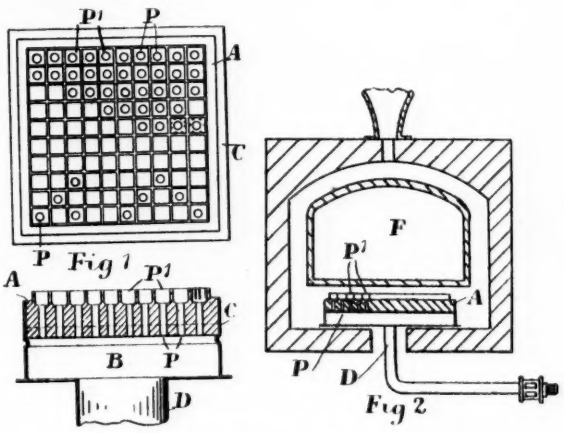
The patentees' claims include: (1) A heating or lighting apparatus comprising automatic means for opening the combustion chamber to the air when the exhaust is not in operation, and for sealing the combustion chamber to the air when the exhaust is in operation, with or without a pilot-light pipe opening into the combustion-chamber and communicating with a gas-main. (2) The combination of a combustion box and burner with means for admitting atmospheric air to the burner; a suction rarefaction apparatus communicating with the burner and combustion box; a gas-supply conduit for the burner; an automatically seatable valve for the gas-supply conduit; and means for automatically unseating the valve on operation of the suction-rarefaction apparatus. (3) A heating apparatus comprising also a thermostatic mechanism and co-operating devices operable to effect automatic unseating of a gas-valve when suction is exerted on the communicating radiators and combustion chambers. (4) The combination, with a heating apparatus (claim 1) having a gas-combustion structure with gas-admission valve, of a vacuum device operable to unseat the gas-valve; an air-pipe leading to a chamber in the vacuum device; an air-chamber structure provided with an atmospheric air inlet communicating with the pipe; a magnet and its armature—the armature controlling the pipe outlet; and a thermostat electrically connected with the magnet and also with a source of electricity.

Bunsen Burner.

WILSON, W. A., of Armley, near Leeds.

No. 25,714; Nov. 9, 1912.

This burner, for consuming a "mixture of any inflammable gas (or vapour) and air," has been designed "to obtain a large number of small well-aërated flames each burning in its own cell or interstice formed in a refractory disc or plate—the burner so formed being adaptable for use in any position."



Wilson's Bunsen Burner for Muffle Heating.

Fig. 1 represents, in plan and sectional elevation, the form of burner or disc employed; and fig. 2 shows an application of the device to a muffle-furnace.

The burner, which is comparatively small in size, comprises a plate A, about ⅛ inch thick and about 2¼ inches square, which gives about a hundred separate burner mouths. The plate is mounted in a casing C in such a manner that a cavity B is formed, which is connected to a mixing-tube provided with a gas injecting bunsen nipple. A gas pressure of 2 inches water-gauge injecting air from the atmosphere is said to give good results with the burner. The casing may carry a fitting D adapted to engage a fitting of the bunsen tube or a mixing-chamber. Thus several burners of standard size might be assembled together and fitted, each by its fitting D, on to or into fittings provided on one or more bunsen tubes.

One side of the plate is perforated with a number of narrow passages or channels P—any shape in section, but of such area of cross section and length as to prevent back-firing of the combustible mixture when lighted, "even when the burner may be radiating against another object." Each of the passages leads into an open cell P^1, having a greater cross sectional area than its passage P. The cells P^1 thus form the exit face of the disc. The walls of each cell surround a flame of the combustible mixture issuing from the channel, and thus the walls become heated.

In fig. 3 is a small muffle-furnace F with a large burner or series of small burners assembled under the muffle; and it has been found by experiment that "the muffle may be rapidly heated up without fear of burning-out or causing cracking owing to uneven heating."

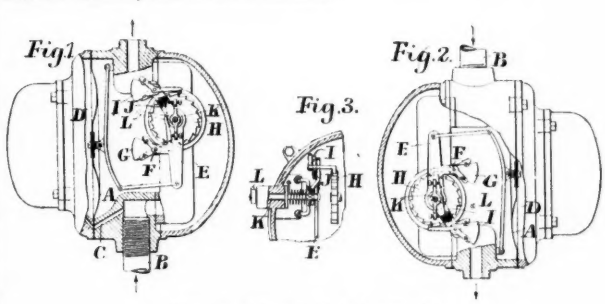
To illustrate the efficiency of the furnace, the patentee states that he has found by experiment that a muffle 8¾ inches by 5 inches by 3¼ inches having walls ¼-inch thick can be heated up to 865° C. in thirty minutes from starting, and after one hour the temperature had reached 942° C.; the consumption of gas being even. With a pressure of 2 inches water-gauge, the gas consumed was 30 cubic feet per hour.

Apparatus for Lighting Gas-Lamps from a Distance.

BERLIN-ANHALTISCHE MASCHINENBAU-AKTIEN-GESELLSCHAFT, of Berlin.

No. 13,605; June 12, 1913. Convention date, July 5, 1912.

This "ratchet mechanism for reversible apparatus for lighting gas from a distance" has for its object to provide such mechanism that the lighting apparatus, without its construction being changed, can be used both for ordinary and inverted burners.



A "Bamag" Lamp-Lighting Device.

Fig. 1 is a vertical section (partly in elevation) of the device for upright burners. Fig. 2 is reversed for inverted gas-burners. Fig. 3 shows in section the hand adjustment device.

In fig. 1, the diaphragm A, which closes at one side the casing, is exposed to the pressure of the gas supplied by the pipe B and branch conduit C into the front chamber D. The oscillation of the diaphragm produced by a pressure impulse is transmitted by the lever system shown to the feed lever E, which is provided with a lateral arm carrying a stop pin parallel to the spindle F. Behind the feed lever is rotatably mounted a tipping weight G, which, in the position of the ratchet mechanism shown in fig. 1, rests on a stop pin parallel to the spindle F and secured to the lighter arm of a double-armed rotatable

pawl, loosely mounted on the spindle. In the arrangement for upright burners, the engagement of one arm of the pawl with the ratchet wheel H is therefore ensured by the tipping weight bearing against the stop pin. The advance of the wheel is transmitted to the gas-supply valve (not shown) in such a manner that the latter is temporarily opened or closed, and in this way gas is admitted into the burner pipe or shut off from it.

If the apparatus is reversed, as fig. 2, for employment with inverted gas-burners, one arm of the pawl remains in engagement with the ratchet wheel H owing to the action of gravity, while the tipping weight G, bearing on the stop pin of the arm, will no longer exercise any action on the pawl.

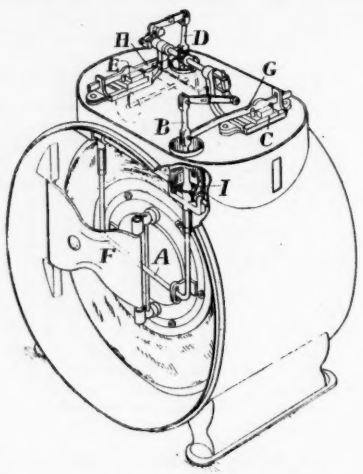
The ratchet wheel H may also be combined with a special hand-adjustment device, shown in fig. 3. The pawl of the adjustment device also co-operates, in the manner described, with a tipping weight I. The arm of the pawl is here provided with an arm bent at right angles to engage the ratchet wheel H arranged laterally of the pawl. The spindle about which the pawl is rotatable is mounted on a feed lever J, which is secured to the spindle K (say) by means of a square portion. To the end of the spindle which projects through the casing is secured a hand lever, by rotating which the spindle, and by means of the square portion L the feed lever J, can be moved in such a manner that the pawl connected to it advances the ratchet wheel to the desired extent. The feed lever is controlled by a helical spring; and its movement is limited at both sides by a double arm mounted on the spindle and striking an inclined projection of the casing.

Dry-Meter Mechanism.

Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, of Paris.

No. 15,255; July 2, 1913. Convention date, Nov. 28, 1912.

This invention relates to the transmission of the movement of distributing mechanisms or driving gears employed in dry gas-meters, so as to remove different inconveniences—viz., the instability in the regulation of the distribution, the absence of tightness of the stuffing-box, with or without the leather cap, and the resistance opposed by the packing to the motion of the parts.



A French Arrangement of Dry Gas-Meter.

According to these improvements, the reciprocating movement of each diaphragm is transmitted to the recording mechanism by a stirrup A, which alternately swings from front to back and from back to front, and turns about a horizontal arm above, which at its ends is provided with pivots mounted in bearings fixed to the wall of the meter. The stirrup transmits an opposite reciprocating motion to the upper extension of the rod B, which traverses the outer wall of the apparatus. This rod simultaneously operates one of the slide-valves C and the recording mechanism of the meter. The driving gear of the two bellows is symmetrically arranged in such a way that the second rod D drives the second slide-valve E, and simultaneously acts on the recording mechanism through the intermediary of a common spindle and a screw on the spindle, which is rotated in one direction by means of crank pins and rods which connect them with the outer pivots of the rods B and D. The inner arm of the stirrup is connected to the bellows by lugs provided with slots, and arranged on either end of the stirrups and perpendicularly to the pivots of the guide F. The stirrup thus serves, together with the guide, to retain the diaphragm and make it move always parallel to itself.

It is thus obvious that, under these conditions, it suffices to fasten the bar G or H of each slide valve at a convenient point of the driving rod, "in order to obtain the desired displacement of the slide-valve on its seat." The movement of the bellows is thus transmitted to the slide-valves without any intermediary other than the two rods; the distribution, even after long operation, being, it is said, uninfluenced either by the play of the moving parts, by their elasticity, or by the forces to which the parts are subjected. "These forces which have only to displace the slide-valves on their seats are practically negligible, and act always in the direction of the rod of the slide-valve—*i.e.*, parallel to the sliding face of the slide-valve."

The number of pulsations of the diaphragms (consequently the volume measured by the apparatus) is recorded by appropriate mechanism. One system of regulation consists in varying the radius of eccentricity of the crank pins on the rods B and D by means of screws, which allow of limiting at will the travel of the diaphragms, and therefore secure a constant measuring capacity being obtained for all meters of the same calibre. "This condition is indispensable in order to exactly record the volume without changing the relation or ratio of the gearing."

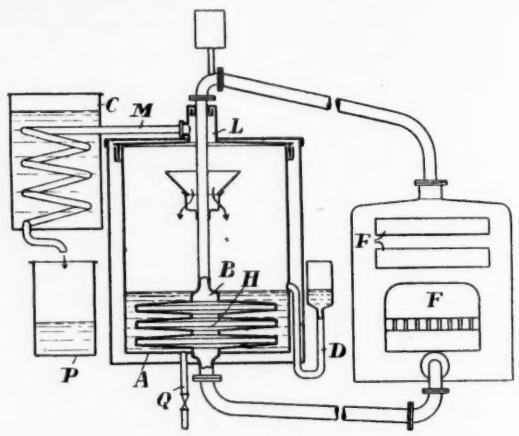
One of the essential characteristic features of the invention consists in the fact that, on each of the driving rods of the slide-valve and of the recording "movement," there is arranged at the centre of oscillation—*i.e.*, at the place where the rod traverses the wall between the slide-valves and the bellows—a diaphragm I, of leather or other flexible material. "From this arrangement it results that the metallic portion cut out for the passage of the rod is replaced by an air-tight diaphragm, which gives no opening through which gas can pass."

Continuous Distillation of Tar.

Gebrüder Keller, Baugeschäft, Aktiengesellschaft, of Lucerne.

No. 14,046; June 17, 1913. Convention date, Feb. 8, 1913.

The essence of this invention is said to reside in the fact that the apparatus for the distillation of the tar is automatically and constantly maintained, by the circulation of hot oil, at the fixed temperature at which water, light oils, and heavy oils distil, and that at certain intervals of time a fraction of the residue in the apparatus—namely, the pitch—is withdrawn, its place being taken by fresh tar, so that the distillation is uninterrupted.



A Swiss Tar Distillation Plant.

In the section given through the tar-still, A is the still, B a device through which hot oil is circulated, and C the condenser. For introducing the tar, there is a pipe D opening into the still at one side. The charge of tar in the still (which charge need not be deep in comparison with the depth of the still) is heated by hot oil circulated through B. This circulating device comprises a heater F and an oil-tank S; the latter being connected by pipes above and below with the pipe system within the still. The system of pipes consists of a pipe connected with the top pipe between S and B and enlarged at its lower end at H, where it merges into several laterally extended horizontal hollow plates adapted to contain the oil. The lower end of the pipe extends through the bottom of the still, and is attached to the pipe connecting the bottoms of S and B. If necessary an expansion vessel I is arranged on the upper pipe. The still is closed by a cover with an opening L at its centre, in which is fitted the short pipe, having a lateral tubulure for connection of the condenser pipe M leading to the worm contained in the cooler C.

By the circulation of hot oil—such as anthracene oil—in accordance with this invention the charge of tar in the still may be heated to a temperature of 250° or 300° C., and maintained constantly at this temperature. To avoid tar being carried over into the condenser by spurting, there is arranged as high as possible in the upper part of the still a funnel-shaped collector, open at its lower part, so that any matter collecting in it can flow back into the still. The distillate is collected in a receiver P.

As the tar undergoes distillation, a fraction of the charge—say, one-twentieth to one-thirtieth—is withdrawn at stated intervals of time as soft pitch through a discharge pipe Q at the bottom of the still, and a corresponding quantity of fresh tar is charged into the still through the pipe D. This small charge of fresh tar finds sufficient room to boil in the comparatively large space above the charge in the still, "while at the same time careful watching to avoid distilling-over is not necessary."

APPLICATIONS FOR LETTERS PATENT.

24,283.—Brown, P., and Bramley-Moore, S., "Univeral joint." Oct. 27.
24,329.—Versen, B., "Gas-producers." Oct. 27.
24,374.—Pictet, R. P., "Production of water gas." Oct. 27.
24,409.—Tuson, F. W., "Coin-freed meters." Oct. 28.
24,426.—Maclaurin, R., "Distilling coal." Oct. 28.
24,436.—Reading, H. C., "Universal joints." Oct. 28.
24,466.—M'Lachlan, R. W., "Gas-governors." Oct. 28.
24,538.—Robin, J. I., "Packing mantles." Oct. 29.
24,571.—Wright, A. C., and Frost, A. C., "Gas-meters." Oct. 29.
24,828.—Fisher, A. L., "Gas-ovens." Oct. 31.

The Board of the Continental Union Gas Company, Limited, have resolved to pay, on Jan. 3 next, a final dividend of 2½ per cent. on the ordinary stock, together with the half-yearly dividend of 3½ per cent. on the preference stock (in both cases less income-tax), making 4½ per cent. and 7 per cent. respectively for the year.

LEGAL INTELLIGENCE.

NORTH SUSSEX GAS AND WATER COMPANY'S FAILURE.

Total Deficiency £17,160.

In the Companies' Winding-Up Division of the High Court, on Monday of last week, meetings of creditors and contributories took place under the liquidation of the North Sussex Gas and Water Company, Limited, of Billingshurst. The OFFICIAL RECEIVER presided.

After dealing with the proofs of debt lodged, the Chairman stated that they were called there to appoint a Liquidator to look after the affairs of the Company. A statement had been lodged by Mr. Jackson, a Director, which showed, as regarded creditors, gross liabilities amounting £7491, of which £345 was expected to rank. The net assets were returned at £4128, all of which were expected to be absorbed by the claims of the debenture-holders—thus showing a deficiency £3345. The capital issued and allotted amounted to £15,520, from which £1702 had to be deducted for unpaid calls, which left the paid-up capital at £13,818. This, added to the creditors' deficiency, made a total deficiency of £17,163. The Company was started under two Acts of Parliament—one for the supply of gas to Billingsburst and neighbouring villages, and the other for the supply of water to the same places. A considerable amount of money was raised; but a large number of the shares now belonged to Mr. Painter, the Company's Engineer. In 1905, the Directors entered into an agreement with the promoters of the scheme (the Finance and Construction Company, Limited), under which the North Sussex Company were to supply and fix mains in the parish of Billingshurst, and purchase land for the erection of the gas-works, &c.; and in return the Finance Company guaranteed a certain dividend every year. Subsequently the Water Act came along; and an agreement was entered into whereby the promoting Company undertook to bore for water, and make up any deficiency in the debenture interest. The purchase price was put at £9000, which appeared to him to be rather excessive. There were certain questions which would have to be gone into, as to the respective rights of the creditors and shareholders; but he could not help thinking that shareholders ought to have made inquiries into the status of the Company before they put money into the concern. It did not look, however, as if they would get nothing at all (though the claims of the debenture-holders appeared to swallow up everything), because there was some question as to the validity of the debentures. The Act of Parliament said that three conditions had to be complied with before debentures could be issued. The first was that certificates must be sent to the Justices of the Peace, stating that at least one-third of the debentures could be borrowed upon; and the second was that no debentures should be issued unless half of the share capital had been paid up. The third condition was that one-fifth of the total amount of each share had to be paid up. Probably they would think the conditions stringent; but it was necessary for them all to be complied with if the debentures were to be held as good in law. It appeared to him there were seven different occasions upon which certificates ought to have been given; but up to the present they had been unable to find them. It seemed therefore absolutely necessary that some investigation should be made into the affairs of the Company. On several occasions it appeared the debentures were not justified. The gas-works actually started operations in 1906, and the water-works in 1908. The accounts for 1907, however, showed a loss of £294; and the accounts for 1908 and 1909 had not yet been discovered. In July, 1910, the Company were in financial difficulties; and a Mr. Lunt was appointed Receiver for the debenture-holders. At that date, also, a change was made in the directorate; and meanwhile Mr. Painter (the Engineer) took action for fees owing, amounting to some £600, which claim was settled later on. A Mr. Beebee was thereupon appointed Manager, and things improved somewhat until the accounts showed a gross profit of £150. In June, 1913, Mr. Painter presented the petition on which the winding-up order was made. It appeared, however, that in 1908 the original Directors had issued £500 worth of fully-paid shares to Mr. Painter in respect of his salary; but that gentleman denied it—stating that the shares were given to him without any explanation, and he concluded they were in a way of guarantee for his future fees. Entries appeared in the books; and it did not look as if Mr. Painter had any claim against the company. Upon the winding-up order being made, a Special Manager was appointed by the Court, and he had filed accounts for the four months during his authority, which showed a profit of some £150. He estimated the annual income of the Company at £850, and the expenses at £659. One of the possible difficulties in regard to the winding-up was that the Acts of Parliament under which the Company came into existence did not give power to sell the undertaking; but he believed the Court had held that any arrangement must meet with the sanction of a Judge before anything could be done. A large amount of money was due from the Finance Corporation; but it was now in liquidation, and the gentleman who practically owned it was also an undischarged bankrupt. Recently, however, a Mr. F. W. Adams, who, he believed, was in some way connected with Mr. Painter, had made an offer of £6000 for the undertaking.

Eventually, the creditors decided to appoint Mr. H. G. T. Davis, of Bassishaw House, E.C., Liquidator of the estate; it being intimated he would take Counsel's opinion as to the rights of the parties, and either carry on the undertaking for a time with a view to sale, or else accept the offer of Mr. Adams. It was also decided to appoint a Committee of Inspection to act in conjunction with the Liquidator.

At the contributories' meeting held subsequently, Mr. J. Westley and Mr. George Gillick, two Directors of the Company, said that they both joined the Company at the latter end of its life, and did all in their power to pull it round to success, and did, in fact, do so. They were in no way to blame for the present position, and ought not to be held responsible for the actions of the previous Directors.

Six shareholders voted in favour of the appointment of Mr. Davis, three for Mr. Campling, and three in favour of the Official Receiver, as Liquidator of the Company. The Chairman said the Court always finally decided in these matters, but it was at all times glad to hear the views of the creditors and shareholders interested.

DISPUTED WATER-RATE ASSESSMENT.

At the Slough Petty Sessions last Wednesday, Benjamin Suckling, a dairyman, carrying on business in High Street, Eton, was summoned by the Windsor Corporation for non-payment of his water-rate.

Mr. Fleetwood Pritchard (instructed by Mr. E. C. Durant, the Town Clerk of Windsor), who appeared for the Corporation, explained that the amount claimed was two quarters' water-rate to June 24; the charge being 10s. 6d. per quarter for domestic purposes, and 2s. 6d. for trade purposes. Mr. Suckling was not an ordinary rate defaulter, but he questioned the right of the Corporation to levy the water-rate on the particular assessment. The rate was levied under section 41 of the Windsor and Eton Water-Works Act of 1883, which provided that the rate for domestic purposes for a dwelling-house should be 4½ per cent. on the gross yearly value in Windsor, 5 per cent. at Clewer, and 3½ per cent. at Eton. What the Corporation were therefore entitled to charge in the present case was 3½ per cent. on the gross yearly value of the premises. This was the only real point before the Bench. There were two grounds on which the defendant disputed the claim—one being that the Corporation were not entitled to charge for the trade supply; and the other—a somewhat unusual one—that the Corporation had no right to make rates on two different assessments. He (Counsel) submitted they were entitled to differentiate, and contended that the defendant had only been charged on the fair valuation of his house. He called Mr. W. B. Mason, an estate agent and surveyor of Windsor, who said he examined Mr. Suckling's premises the previous day, and was of opinion that they were at present worth £36 a year—the landlord undertaking the repairs.

Defendant was called, and said the water was never used for trade purposes; all the cleansing being done on the Windsor premises. This part of the claim was thereupon struck out. In answer to Mr. H. N. Philcox, who defended, witness said he had been tenant of the premises since 1901, and paid £30 rental. He had spent upwards of £100 in repairs since he had been there; but he was not under any agreement to do repairs. He spent money to improve the place for his own purpose. He considered £20 to £21 ample for it. The poor-rate valuation was £21 assessable, and it was rated at £17. When the rent was fixed, property was worth more in Eton.

The Chairman (Mr. J. Hartopp Nash) said the Bench had carefully considered the case, and they were of opinion that the assessment was a fair one, and therefore a distress warrant must issue for the payment of the 10s. 6d.—the 2s. 6d. having been struck out. At the same time, they did not wish to express any opinion as to the different principle of rating assessments in Windsor and Eton.

A Big Australian Law Suit.

We learn from Messrs. William Coward and Co., Limited, No. 100, Bishopsgate, the London Agents for the Australian Gaslight Company, Sydney, that early next year—if a settlement is not in the meantime arrived at—a claim amounting to somewhere about £750,000 will occupy the attention of a Supreme Court Judge and Jury. The claimants are the Australian Gas Company, in respect of the resumption by the State Government of their premises in Kent Street. The Government, it is understood, have offered the claimants £450,000 in full satisfaction of their claim. Although the writ has not yet been issued on behalf of the claimants, Counsel have been retained by both sides. Mr. Adrian Knox, K.C., Mr. Lamb, K.C., Mr. Harry Stephen, and Mr. Alroy Cohen (instructed by Messrs. Allen, Allen, and Hemsley) have been retained on behalf of the claimants; and Mr. B. R. Wise, K.C., Mr. J. L. Campbell, K.C., Mr. Pike, and Mr. Alec Thomson (instructed by the Crown Solicitor) on behalf of the State Government.

Gas v. Electric Cooking in Battersea.

It may be remembered that a few months ago the Battersea Borough Council had under consideration an application from their tenants on the Latchmere and Town Hall Estates to be supplied with gas cooking-stoves; a petition in their favour having been presented by 300 out of the 315 tenants on the first-named estate, on the ground that the electrical cooking stove had been found to be "a dismal failure." The Council agreed to introduce gas-stoves; and the effect of the change is referred to by an employee of the Gaslight and Coke Company—an occupier on the estate—in the current number of the "Co-Partners' Magazine." His description of what used to go on before gas was admitted for cooking is not given, as it is stated to be "rather too vivid for publication;" but the concluding remarks in his communication are as follows: "What a difference gas has made to the estate! Smoke now is seldom seen rising from the chimneys. One coal merchant confesses to selling 16 tons less in one week. Gone, but not forgotten, the 'scent' of dirty oil-stoves, the 'tarry log' merchant with his wood blocks, reminiscent of London streets, which, when put on the fire give off such a pestiferous smell. Now we have the gardens better, the flowers cleaner, the atmosphere bright and pure!" The editorial comment is that "this testimony ought to be appreciated by the Smoke Abatement Society."

The chief feature in the Lord Mayor's show yesterday was a reproduction of the pageant of 1613, the year in which the New River scheme for the supply of water to London was completed. Sir Hugh Myddelton, its originator, and Sir Thomas Myddelton, the Lord Mayor, were brothers. Some of the scenes and characters as then depicted were revived; and about 160 performers, most of them on horseback, took part.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting was held last Tuesday, at the London Offices, No. 21, Austin Friars, E.C.—Sir CHARLES J. JESSEL, Bart., in the chair.

The SECRETARY (Mr. Robert W. Wilson) read the notice convening the meeting, the Auditors' report, and the scheme for the appropriation of the profits.

The Directors' report and the balance-sheet were taken as read.

A PREDICTION, AND THE RESULT.

The CHAIRMAN: Ladies and gentlemen,—The somewhat sparse attendance to-day confirms me in the opinion I have long held that two meetings a year are perhaps one meeting too many; and I can only express my regret that this Association had not the same fortune as the railway companies of Great Britain and Ireland had to be included in the recent Act which necessitates only one meeting being held per annum. Perhaps some public-spirited proprietor will promote, and (I need hardly say) pay for, an Act of Parliament which will relieve us from one of the two meetings. [Laughter.] The sparse attendance to-day may perhaps be accounted for in some degree by the fact that last May I indulged in a prophecy as to our fortunes in the half year now under review. I was then so bold as to say that it was going to be a "bumper" half year. As a matter of fact in the report that went out to the proprietors the word "bumper" did not appear. Within forty-eight hours of our last meeting, Mr. Tindall and I went abroad to visit the Antwerp, Brussels, Hanover, and Berlin stations; and I was obliged to leave the editing of my speech in the hands of our Secretary. In Mr. Wilson's large experience, extending over forty years, he had never heard any Chairman of the Imperial Continental Gas Association use such a vulgar expression as "bumper" [Laughter], so he toned it down to the more moderate word "successful." I beg to say I did use the word "bumper;" and those of you who were present then will bear me out. It has been a bumper half year; and I will show that it has been so when I go through the report and accounts.

A RECORD PROFIT, AND A POLITIC SALE.

The important part of the report is in the second paragraph, which deals with the profit of the half year, which amounts to £286,479. This profit beats the previous record of the first half of 1911 by nearly £5000, when we were still operating both at Aix-la-Chapelle and in the suburbs of Vienna, both of which were fairly profitable contracts. Of course, I do not wish the proprietors to be under any delusion that, through having lost these stations, we lost all that the stations meant. We were able to sell the works and mains at Aix-la-Chapelle at a very reasonable price; and we were also able to dispose of our property at Vienna to the tune of several thousand pounds. Through the employment of this capital in other directions, we are now in the position to increase the profit of the Association generally. In fact, I may say that sometimes it does, in rare instances, occur that the sale of some of our stations, and the resulting moneys that accrue to us from the sales, are more profitable than the works themselves. You will see on the next page of the report the statement that "the Directors have to report the sale, at a fair price, of the concession and the works at Cernay—a small town in Alsace." Personally, I never was at Cernay; and few of my colleagues have been there. The expense of reaching the remote place would probably take about a month's profits off the station's half year. We sold this small station for round about £5000; and if we credit ourselves with the moderate return of 4 per cent. on the £5000, I can only say that I should have been very glad had we been in the past getting £200 a year out of Cernay.

WORKING DETAILS.

I now come to the output of gas in the towns supplied by the Association. You will be pleased to hear with respect to the sale of gas (which is the important thing so far as we are concerned, as opposed to the output of gas) that we have made up in a twelvemonth for the loss of Aix-la-Chapelle. Then you will see we have increased our length of mains by 71 miles. These mains have been mostly laid to consumers round the towns which we already supply. Coming to the coal carbonized, you will notice that the average gross cost is 2 2d. less per ton than in the corresponding half year of 1912. This will not surprise you when you remember that I alluded at the last meeting to the delay that occurred in the delivery of our coal under the English contracts—a delay occasioned by the strikes; and therefore, in this half year, we have had the benefit of the lower price under the old contracts. This saving in the cost of coal amounted to about £7000. Besides the manufacture of gas, you all know well that part of our business is to be merchants; and coke is a most important residual. We realized from coke £35,000 more; from tar, 26 per cent. more; and from ammoniacal liquor, 6½ per cent. more.

THE BALANCE-SHEET EXAMINED.

I do not think that there is anything further in the report that will be of interest; and I will now take you to the balance-sheet. On the liability side, the only thing that calls for any remark is sundry creditors, which, you will see, has come down from £765,000 odd to £599,177. This is accounted for by our having paid another instalment of the amount we have to pay to Hanover for the new contract. The last, and final, instalment will be payable next April; and therefore this time next year this item of sundry creditors will have been further reduced. On the other side of the balance-sheet are the assets. The most important item there is works, mains, &c., which is down by about £200,000. Here I will refer to the item of sundry debtors, which is up by about £200,000, which means that the money we have to receive for works and mains from places such as Aix-la-Chapelle now appears under sundry debtors, and this money is due to us. We have, in the shape of half the payment that has still to be made by Aix-la-Chapelle, very nearly £150,000 (3 million marks); and this has to be paid on April 1 next year. The item of freehold land is a little different; and this arises from the sale of land at Vienna. The item of general stores is up by about £70,000; but we have had a large stock of material in hand—principally mains, as you will well understand from what I said just now as to the long lengths of mains that have been laid. Cash at stations—always an interesting item to everybody—is down; but there again I refer you to loans. Loans are up by very nearly the same amount that cash is down. The fact is that this time last year it was necessary to keep a larger amount abroad for payments that had to be made, and this is money that is not required at the present moment. There is a small increase in Imperial Continental Gas Association 3½ per cent. debenture stock. We do not go out of our way to buy this stock, which is one of the finest securities known in the civilized world. Occasionally when small amounts are brought to our notice, which otherwise do not find a home, we are able to acquire them at reasonable prices. Then, again, you will see that miscellaneous foreign securities are a little up; but we have not now got any of the Belgian Government Treasury Bills. Therefore, really, the position remains about the same.

THE DISPOSAL OF THE PROFIT.

This leaves us to go back to the interesting question as to what we intend to do with our profit of £286,479; making, with the balance forward, £305,047 available for appropriation. The Board propose (as I shall presently move) to pay you a dividend of 4½ per cent. for the half year, which will absorb £222,300; to carry to the credit of the pension reserve, £40,000; and to carry forward, £42,747. You will remember that last May Mr. Fox wrote me a letter, protesting, in a very nice way, against robbing the carry-forward. On that occasion, we took £26,040 from the carry-forward; and I should like to point out to you that on this occasion, we replace £24,179 of the amount. Therefore, our carry-forward will be very much what it was this time last year.

DIVIDENDS AND CAPITAL EXPENDITURE.

The Secretary put into my hands as I came here to-day a letter from a proprietor—Mr. Arnold Steer, who writes from Lindfield, Sussex. In the course of his letter, he says:

> I am sorry that I find it impossible to attend the meeting on Tuesday next, as otherwise I should have been sorely tempted to enter a mild protest against the ultra-conservatism of the Directors in the way of dividends. I think, and know, that this opinion is widely shared, that the time has arrived when there should be a slackening of the rate at which the "Pension Reserve" is being piled up at the expense of this generation of shareholders.

Now, gentlemen, I should like to reiterate what probably has been often said from this chair, that your Directors will increase the dividend at the earliest moment that it is considered advisable to do so. I think that your old proprietors know very well that this is only an industrial concern; and an industrial concern cannot afford each half year to divide its profits up to the hilt. Besides this we have not got even the advantage that an industrial gas company has in this country. We are in the position of leaseholders, and leaseholders who can only renew by sometimes paying very heavy fines, and very often by having to pay an increased ground-rent. We must have margin to be able to renew, or else we could not renew at all. I can only give you an example of this by saying that, only a few years ago, a renewal in the case of one of the communes of Berlin entailed the lump sacrifice of no less than £10,000 per annum. We ran the risk as we must run risk—a present risk in order to gain future profit. If we divided up to the hilt each half year continually, we should have to appeal to the public for new capital requirements. I may say, to give you an example, that we have, only during the last week, had to approve of capital expenditure amounting to a quarter of a million sterling. If we had had to appeal to the public for such capital expenditure, through paying you up to the hilt, this business would not be in the position that it now is in the City of London, and would not be esteemed in the way it is by the Stock Markets everywhere. [Hear, hear.] The report has shown you that the Directors, even if they have not been able to gain concessions in new towns, have done their utmost in developing the suburbs and villages near the towns the Association supply with gas. I reported last May that we had made a contract which expires in 1982; and it may interest you to know that we are negotiating for, and hope to shortly conclude, a contract which will not expire till the year 2000. [Laughter.] Besides getting these new contracts, there is also the question of finding consumers of our gas; and I can only assure you that no opportunity is lost of demonstrating the use of gas both in the dwelling-house and in the factory. Under the direct auspices of the Association, and with a committee composed of the technical staff, the first International Gas Exhibition which has ever been held in Belgium was opened in Antwerp on Feb. 22 last; and there were over sixty manufacturers, from Belgium, England, France, Germany, Holland, and the United States, exhibiting there—being represented by the latest devices in gas apparatus for lighting, heating, and power. From the very first day of the formal opening—an opening which took place in the presence of the military and civil Governor, the Burgomaster and aldermen of the town—the exhibition was a great success; and I believe that it has given an undoubted fresh impulse to the gas business in that country.

NEW AGENT IN BERLIN.

You will remember that at the last meeting I referred to the almost irreparable loss occasioned to the Association by the death of our agent in Berlin—Mr. L. Delbrück. It is now my pleasurable duty to inform you that we have appointed, to take his place, his partner, Mr. Carl Joerger. I need hardly say how advantageous it is for the Association to be represented by a member of the firm of Messrs. Delbrück, Schickler, and Co. As Mr. Joerger has naturally always been in some degree in touch with the Association, the continuity of relationship between the firm and the Association is maintained by his appointment. I may say that Mr. Carl Joerger, who has been known to several of us for many years, is an able man, and a man of most charming personality; and, from the short experience we have had of him in his present

position, we are perfectly certain that a very happy appointment has been made.

PENSION FUND.

With regard to the pension fund, which is generally spoken of by the Chairman, the Secretary has given me certain figures which show the necessity of maintaining this fund. The claims on the fund continue to grow; and now amount, he tells me, to £53,933, of which £29,369 represents annual charges for officers' and officers' widows' pensions, and £24,564 for workmen and workmen's widows. We have 364 pensioners over 70 years old, one of whom is 93 and 42 are 77; and these take £17,176.

INSURANCE OF SALARIED OFFICERS.

Then we have had another blow in the way of a German law for the insurance of salaried employees. This began on Jan. 1 last; and now all salaried officers who earn from £27 10s. to £250 per annum must insure under this law. I will not go through the various premiums; but what will interest you is that the Association's moiety for the year 1913 is estimated as being £1933. The German Treasurer—the Lloyd George of Germany—is a very clever person, because he has also laid down that there shall be no pensions until the premiums have been paid for at least ten years. The result of this is that he will get a lot of lapsed money. During this period, the Association has to pay its share of the compulsory contributions in addition to the amount it pays direct in pensions. Another interesting feature about the scheme is that pensions will also be given to the widows and children of salaried employees; and the most favourable case that can possibly occur will result in a pension of £72 8s. per annum to the employee.

PROSPECTIVE TAXES.

Bearing on the question of these taxes on the Association, I think I ought to warn you that, satisfactory as this half year is, there are ahead two or three little rocks in the way of taxation. I daresay most of you have read about the German war tax. Nothing is yet absolutely settled regarding it; but, so far as we can make out, what is proposed and what is expected will be approved by the Bundesrath, is that this taxation, which will be leviable on the assessed value of the Association's possessions throughout Germany, will amount to about 1½ per cent. It has not, as I said before, been absolutely settled. The basis of the assessment is not clearly defined yet; and we cannot positively say what is at present proposed. Therefore I cannot give you any figures as to what it means to the Association. Anyhow, the money will be payable in three instalments in the years 1914, 1915, and 1916. Nasty as these taxes may appear to you, when you remember that you and your predecessors in title, as proprietors in this Association, have enjoyed the benefits for many years of business relations with Germany, you will bear these taxes with fortitude and cheerfulness. [Sir CHANDOS LEIGH: Fortitude perhaps, but not with cheerfulness.] I am very sorry to say that, although Belgium does not indulge in any luxuries such as large war vessels or other hideous armaments of the sea, she has also felt, in spite of all the guarantees that the united Great Powers can give, that she has been insecure with respect to her army. Belgium has therefore largely increased it, and has largely increased her taxation. We have been subjected in Belgium to 2 per cent. on our profits; and they have now been kind enough to double it—making it 4 per cent.

MR. HORSLEY PALMER'S RETURN.

I should not like to make this motion, and sit down without referring to the presence here of my predecessor in the chair, Mr. Horsley Palmer. You will all be glad, as are his colleagues, to see him back again. [Hear, hear.] Mr. Palmer happened to succeed a gentleman who was elected a Director of the Association in June, 1836, and who lived to April, 1875. Mr. Palmer succeeded him in April, 1875; and he looks as though he is going to beat his predecessor's record very easily. He only wants a few more weeks in which to do it.

A NEW DIRECTOR AND CONTINENTAL INSPECTIONS.

As a new Director, you have Sir Guy Fleetwood Wilson, who has been on the Continent visiting the stations at Antwerp, Brussels, Hanover, and Berlin, under the able guidance of Colonel Le Roy Lewis and Mr. Newton. We generally consider on this Board that no Director is of much value to us, such is the complex and intricate nature of our concerns, diplomatic, technical, and financial, under about two or three years. Sir Guy has only been with us two or three months; but such is his mastery over facts and figures, and his intellectual digestion is so strong, that I think we shall look upon him, in a few weeks, as quite an old hand. Besides this visit of Colonel Le Roy Lewis, Mr. Newton, and Sir Guy, the Colonel (who is ever active in travelling in your interests on the Continent) accompanied me on a most interesting tour, visiting the various French stations. Although we have no stations of our own in France, we have there very large interests, as may be known to several of you; and we visited I cannot tell you how many works in France belonging to no less than six French companies, electrical and gas. Not only were we charmed with the progress that had been made, but we became convinced that these French shareholdings would very shortly be to you a most valuable thing.

THE FORMAL MOTION.

I do not know that there is anything else that I need speak upon on the present occasion. I will therefore conclude by formally moving—"That the report of the Directors upon the affairs of the Association, together with the scheme for the appropriation of the profits, which has been read, be received and adopted, and entered upon the minutes." To save time, I will also move what I consider correctly belongs to the resolution—"That a dividend of 4½ per cent. for the half year ended the 30th of June last be declared upon the £4,940,000 stock of the Association, and that the same be payable, less income-tax, on the 11th of November, 1913."

Mr. ARTHUR LUCAS seconded the motion.

Sir JOHN RUNTZ said the proprietors had listened with a great deal of pleasure and interest to the account of the Chairman's bumper year. It was said that one should never prophesy unless he knew. To have increased the profits by £38,000, he thought was a great achievement; and taking the two half years together, he found the total net profit was £552,738. He thought he was right in saying that this was the largest figure they had ever reached in the history of the Association. The proprietors congratulated the Directors upon the achievement. There was a very interesting item on the credit side of the balance-sheet. It was seen there that they had £2,500,000 in liquid assets. This was an important factor, because the Chairman had said there were occasions when money had to be found; and this was a substantial nest-egg upon which they could fall back. The Chairman had referred to the pension fund. This was a half-yearly affair—a very large sum indeed; and he did not know whether the Chairman and his colleagues had it in their minds to fix any sum at which the pension reserve fund should stop. It now amounted to £535,000; and £80,000 a year was appropriated, which was a very solid sum. Taking the ordinary capital at roughly £5,000,000, the £80,000 represented 1½ per cent. on this amount. But for that stumbling-block, he thought they would have reverted to their 10 per cent. many years ago. The proprietors appreciated what had been called the conservative financial policy of the Association. It had been one of its mainstays; and they would not have been in the present position if it had not been for the foresight of the present and past Directors. He should like to know if the proprietors could have some idea as to whether there was any fixed amount for the pension fund reserve, so that the money now transferred to it would be available for a higher dividend.

Mr. HOWES asked whether he understood correctly that at present the Association did not hold any Belgian Government stock.

The CHAIRMAN said that was so.

Mr. HOWES: This time last year you held about £78,000.

The CHAIRMAN: Yes, Sir; Treasury bills. Proceeding, he said that, with reference to Sir John Runtz's question, he might remind the proprietors that Mr. Palmer, when in the chair, distinctly told the proprietors that the Directors looked forward to a pension fund of a million sterling. With respect to his prophecy, of course in May with the months of January, February, and March behind, it was not much to prophesy what the result of the half year was going to be; but he was not going to venture on such a thing that day—November being a very different time, with very different months before it.

The motion was unanimously carried.

Sir JOHN RUNTZ moved a vote of thanks to the Chairman and Directors and the officers and staff, both at home and abroad.

Mr. BERNARD F. HARRIS seconded the motion, which was cordially agreed to.

The CHAIRMAN, in thanking the proprietors, said he was supported by most able and loyal colleagues, and by a staff, here and on the Continent, that was second to none anywhere.

COLONIAL GAS ASSOCIATION, LIMITED.

A Big Increase—Changes in the Directorate.

The Ordinary General Meeting of the Association was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. SAMUEL SPENCER in the chair.

The SECRETARY (Mr. Alfred J. Kingdon) read the notice calling the meeting, and the Auditors' report; and the Directors' report and the accounts were taken as read.

The CHAIRMAN, in moving their adoption, said it was his sad duty to inform the shareholders that, shortly after the last meeting, the Board heard of the death of their much respected colleague, Mr. Parkinson. He was an original Director, and took the greatest interest in the prosperity of the Association, being seldom absent from their meetings. The Board deeply regretted his loss; for never, during the whole time of his connection with them, did they have a discordant note from him. The Directors, on their own behalf and the shareholders', had sent a message of sympathy and condolence to Mr. Parkinson's family; and this he (the Chairman) was sure the shareholders would confirm. His next duty was to say that the Board had, with much regret, to announce the resignation of the Hon. George Swinburne, who had been Managing-Director in Australia for some years, and occupied the position of Chairman since Sir Thomas Bent's death. It was indeed with the greatest possible reluctance that the Board had to accept his retirement. It was, however, inevitable, as the Federal Government had offered him the great honour of being one of the three Interstate Commissioners. The Board, and he felt confident the shareholders, would wish Mr. Swinburne good health and much success in carrying out the duties of his high office. Personally, he (the Chairman) felt his loss very much, as he knew Mr. Swinburne when he went out to Australia 25 years ago, and had been in correspondence with him all these years. Especially did he (the Chairman) feel the severance, seeing that it left him the only original Director of the Association. He had further to report the resignation of Mr. Andrews, who was an Australian Director for 21 years; the separation in this case being due to ill-health. Mr. Andrews was a most agreeable colleague; and the Directors accepted his resignation with much regret and the best of wishes for his restoration to health. These drastic changes in the management of the Association's concerns gave the Board very much anxiety; but he was pleased to say they had been able to fill the vacancies with the most satisfactory results, and, they were certain, to the satisfaction of the shareholders. In place of Mr. Parkinson, they had appointed Mr. King-Hiller, who (since his retirement from the chief engineership of the Shanghai Gas Company, which he successfully managed for many years) had been practising in Westminster as a Consulting Engineer. They had also appointed Sir John Taverner as a Director, and felt much honoured that he had accepted the position. Sir John had for the past ten years been the Agent-General for Victoria in England; and, knowing the Colony so well, his presence as a member of the Board was a great acquisition. He had only recently returned from Australia, and would assure the shareholders, if it were necessary, that the position of the Association, and the prospects out there, were as satisfactory as could be desired. In Australia, they had been most fortunate in filling the vacancies. It was with the greatest possible

pleasure that they had been able to appoint Mr. Philip Holmes Hunt as Chairman of the Australian Board. Mr. Philip Hunt was a son of their colleague on the Board; and he went to Australia about ten years ago as Engineer to the Metropolitan Gas Company of Melbourne, and for the past five years he had been Chief Engineer. The Association were most fortunate in securing his services. After Mr. Swinburne announced his resignation by cable, he wrote fully regarding the appointment of a successor, and said how pleased he was that Mr. Philip Hunt had accepted the position of Chairman. The Board at once cabled confirming the appointment. He would read two or three sentences from Mr. Swinburne's letter. He wrote:

> Mr. Hunt has consented to take my position; and I am cabling you to that effect. I can assure you it is a great relief to my mind to have such an able gas engineer, and one who has considerable organizing power and tact, to represent you in Australia. I do not know of anyone in whom I would have more confidence in leaving my position to than Mr. Hunt; and it is a great relief that I have been able to fix this up on your behalf.

In place of Mr. Andrews, the Board had appointed Mr. S. E. Figgis, for many years the capable Engineer and Manager of the Ballarat Gas Company. He was a friend of Mr. George Swinburne, who strongly recommended him for the post. Mr. Figgis had been in England lately; and the Board had the pleasure of making his acquaintance. They felt confident that they had made an excellent choice. Mr. William Swinburne became Managing-Director; and as he had been with the Association from the start, and knew well all their doings and various works, the Directors had the fullest confidence in him. He (the Chairman) thought that what had been done here and in Melbourne in connection with the directorate had resulted advantageously, and to the best interests of the Association. It would be remembered that at the last meeting the Board anticipated a very successful year; and he was pleased to say the results had exceeded what was then foreshadowed. Fully assured, too, were the Board that the coming year would prove equally satisfactory. Last year, the Directors announced their intention of applying to the Court to sanction an alteration of the Articles of Association, and to obtain an order to cancel the founders' shares. Mr. Justice Neville readily granted the request, as he at once saw that it was in the best interests of the shareholders. Since the last meeting the Board had acquired the Horsham works, but the negotiations for the other works that they had hoped to secure had meanwhile dropped through, as they could not obtain them on suitable terms. Turning to the report and balance-sheet, everything was so clearly set forth that he thought it was not necessary to say much about them. The Directors had the pleasure of announcing the large increase of 28 per cent. in the sale of gas, which was a record in their history. In order to meet this demand, it had been necessary to extend the plant, which, with the acquiring of the Horsham works, had cost some £20,000; and a further expenditure in the near future would have to be made, seeing that the increased consumption of gas for the current year already showed nearly 20 per cent. increase on the large one of the past year. The profit for the year was £8768, against £7243 last year. This he felt sure would be considered highly satisfactory, and fully justified the Board in declaring the extra dividend of ½ per cent., making for the year 6½ per cent. The revenue from the sale of gas had increased by nearly £6000, and from residuals by £840. The increased expenditure for coal and wages, repairs, and maintenance was about £4700. Of this nearly £1700 was for wages; £1400 was for coal to meet the increased consumption of gas; £750 more was written off for depreciation; and £850 more was spent on repairs; also £400 was transferred to the reserve fund. During the year, 1000 additional meters were fixed; and 850 cookers, heaters, and grillers were installed. The sale of gas averaged upwards of 10,000 cubic feet per ton of coal carbonized; and the leakage was 8 per cent. The average price of coal was a little less than last year. From what he had said he felt confident that the shareholders would be highly satisfied with the year's working.

Mr. CHARLES HUNT, in seconding, said the Chairman's speech had so thoroughly covered the ground, that any remarks he made might appear to be superfluous; but he would like to be allowed to emphasize the exceptional interest and importance of the report which had been submitted to them that morning, if only on account of the retirement of one who had been, he might say, the leading spirit of the Association from its formation. The loss of Mr. George Swinburne to the Association could scarcely be measured. But they had done the best they could in the circumstances; and the Board felt that, in the arrangements they had made, the interests of the Association were as fully assured as they could possibly be. They looked forward to a continuance of the prosperity which had marked the year just ended, although it could hardly be expected that the exceptional percentage increase could be maintained.

Mr. G. T. S. TRANTER congratulated the Board upon the exceptional position of the affairs of the Association. The shareholders were pleased to think that, although the scope of action was so far away, they had such good and favourable help in the Colonies. They were all pleased to have the extra ½ per cent., and hoped continued good business would result in another ½ per cent. in due course.

The motion was unanimously carried.

Moved by the CHAIRMAN, and seconded by Mr. H. KING-HILLER, a final dividend of 4½ per cent. (less income-tax), making 6½ per cent. for the year, was declared.

Proposed by the CHAIRMAN, and seconded by Mr. F. R. SMITH, the retiring Directors (Mr. H. King-Hiller, Sir John W. Taverner, and Mr. P. C. Holmes Hunt) were re-elected.

The Auditors (Messrs. Wood, Drew, and Co.) were re-appointed, on the motion of Mr. W. J. RUSSELL, seconded by Mr. HUNT.

The CHAIRMAN remarked that the last clause of the Directors' report was unusual. It said that "a motion will be submitted to the meeting for increasing the remuneration of the Directors." For 25 years the Association had had Directors; and all along they had had very poor remuneration. With the present good balance-sheet, and the prospects of the future, the Directors thought the time had come when they might fairly ask the shareholders to be good enough to increase their fees. What they were proposing was not a large addition to what they had been receiving. His proposal was that the remuneration of the Directors should be increased to at the rate of £100 per annum, multiplied by the number of Directors for the time being, with the addition as provided by article 73 of the Articles of Association, and to be paid free of income-tax.

Mr. J. T. MAITLAND seconded the motion.

It was stated in reply to a question that the increase per Director was from £60 to £100.

The motion was unanimously agreed to.

Mr. TRANTER, in proposing a vote of thanks to the Chairman and Directors at home and in Australia, also the staff, expressed the opinion that the Directors deserved the addition to their fees. A similar expression of opinion fell from Mr. W. CHAFFER, in seconding. He added that he rejoiced to see the name of Mr. Philip Holmes Hunt added to the Australian directorate, as he was sure he would be a source of great strength to the Association.

The motion was heartily carried.

On the proposition of the CHAIRMAN, seconded by Mr. W. J. RUSSELL, a resolution was passed thanking the Hon. George Swinburne for the splendid work he had done for the Association, and wishing him all success in his new office, and health to carry out its important functions.

Acknowledgement was also made, in a resolution moved by the CHAIRMAN, and seconded by Mr. W. H. ELY, of the great services to the Association of Mr. Henry Andrews, accompanied by the desire that with rest there might be a thorough restoration to health.

WEST BROMWICH GAS UNDERTAKING.

Decreased Sales—Serious Increase of Leakage.

At a Meeting of the West Bromwich Town Council last Friday, a discussion took place on a report presented by the Gas Committee, in which it was stated that the gas-rental for the quarter ending the 30th of September showed a decrease of £467, as compared with the corresponding period of last year.

Mr. J. BROCKHOUSE (the Chairman of the Gas Committee) said it was not a pleasing feature of the report that there was a reduction in the gas-rental for the past quarter. But he reminded the Council that there had, for some time past, been exceptionally bright weather; and this had contributed somewhat to the reduction in the quantity of gas sold. He ought to add that the percentage of leakage had been higher than it had been for a long time. He might as well be frank with the Council, and explain that the report of the Gas Engineer (Mr. Harold E. Copp) of what gas had passed through the station meter and what was recorded at the Town Hall in sales differed considerably; and Mr. Copp was anything but satisfied over the matter. He had sent out men who were trying to discover the leakage; and if they were unsuccessful, he suggested that some independent person should undertake the duty. The average leakage was about 3 or 4 per cent.; but for the past quarter it had been about 7 per cent., which was an exceptionally large proportion. However, the whole matter would be gone into by the Gas Committee at their next meeting. He thought the reduction in the price of gas was responsible for some of the decrease in the rental. The Committee themselves were surprised at the difference in the amount of the sales and the quantity of gas which had passed through the station meter; and they felt, after seeing the Borough Treasurer and ascertaining the accuracy of his account, that there was something wrong. If their own men could not detect the cause of the extra leakage, the Committee would have to employ someone from outside.

The report was adopted.

RETFORD GAS AND WATER UNDERTAKINGS.

Annual Reports.

At the Meeting of the Retford Town Council yesterday, the reports on the gas and water undertakings for the year ended the 30th of June were submitted.

The Gas Committee reported that there had been expended in the twelve months the sum of £951 on capital account; bringing up the total to £56,500. The revenue from the sale of gas and the rental of meters and stoves was £9437, compared with £9140 for the preceding year; being an increase of £297. The residuals realized £4364, against £3883. The gross profit was £3123 and the net profit £1773, against £3470 and £2120 before; the difference being accounted for by the increase in the price of coal, which cost £600 more than in the year 1911-12. The Committee have arranged for the coal supply for another year at a still further advance in price of 1s. per ton, which, together with the previous advance, makes 3s. 6d. beyond the price of two years ago. This will reduce the profits in the future; but a portion will be returned by the slightly better price obtained for residuals. The Engineer and Manager (Mr. J. B. Fenwick) reports that the works and plant have been maintained in good condition; and the undertaking continues to make a progress which the Committee hope is satisfactory to the Council and burgesses generally.

The Water Committee stated in their report that a sum of £658 had been spent for capital purposes during the year; making an over-expenditure of £767. They recommended that £1500 should be transferred from the profit and loss account, which stands at £2215. This would clear off the over-expenditure, and provide for the payment of the next section of the new main on the London Road, which is now in hand. The revenue account shows an income of £3250, compared with £3107 for the preceding year. The working expenses and charges against revenue amount to £1549, compared with £1738. After paying the usual instalments of the sinking fund and interest on the loans, there is a net profit of £1247; being an increase of £360, which the Committee consider is highly satisfactory. The water undertaking has cost £29,618, the whole of which has been repaid with the exception of £645 owing on the loan account. The Engineer and Manager reports that the works, plant, and machinery are in good order.

ASHBORNE GAS-WORKS PURCHASE ARBITRATION.

The Case for the Company.

An arbitration took place at the Surveyors' Institution, Great George Street, S.W., on Monday, Tuesday, and Wednesday of last week, to determine the price to be paid by the Urban District Council of Ashborne for the undertaking of the Ashborne and District Gas Company. The proceedings are reported to-day so far as the case for the Company is concerned; the arguments and evidence for the Council being reserved for our next issue.

Mr. Ernest Moon, K.C., acted as Umpire; and there were with him as Arbitrators Sir Corbet Woodall, D.Sc., for the Company, and Mr. Harry E. Jones for the Council.

The Counsel appearing were Mr. C. C. Hutchinson, K.C., and Mr. W. J. Jeeves (instructed by Messrs. Hargreaves and Crowthers) for the Company; and Mr. Honoratus Lloyd, K.C., and Mr. St. John D. Raikes (instructed by Messrs. Dyson and Co.) for the Council.

Opening Speech of Counsel.

Mr. Hutchinson, in presenting the case for the Company, explained that the arbitration was held under the provisions of the Ashborne and District Gas Act of 1911, and the Ashborne Urban District Council Act of 1912. By the Act of 1911, the Company were incorporated, and became a statutory undertaking; but they had actually been carrying on operations since 1840. The limits of the Act were for the supply of gas to the urban district of Ashborne, and the parishes of Clifton and Compton. These were the districts to which the operations of the Company, in all material respects, had up to the present time been confined. There were also various other places in the County of Derby as well as the parishes of Mayfield and Okeover in the County of Stafford. Ashborne in 1891 had a population of 3809, with 801 inhabited houses; while this year the population was estimated to be 4070, with 950 inhabited houses. Apparently the increase in population was not nearly so large as the increase in the number of inhabited houses; and this was a fact which spoke for itself with regard to the value of the increase in the gas supply which had been experienced. The rateable value in 1901 was £15,262; in 1913, £18,692. Both in Ashborne and in some of the surrounding districts there were important factories, which took gas for power, as well as for lighting and heating. The capital of the Company under the Act of 1911 was £30,000—£20,000 original and £10,000 additional—with the usual one-third borrowing powers. The statutory dividend was 8 per cent. on the original capital, and 5 per cent. upon the additional capital. They were under the sliding-scale, with a standard price of 3s. 4d. per 1000 cubic feet. However, the valuation which the tribunal had to make did not depend upon the exercise of the statutory powers under the Act of 1911. The undertaking was to be sold on the basis that the Act of 1911 had not been obtained—that was to say, the award would treat the Company altogether as a non-statutory one. The price at present charged for gas within the urban district of Ashborne was from 2s. 11d. to 2s. 5d. per 1030 cubic feet, according to the quantity that was taken, for lighting. For power, the charge was from 2s. 6d. down to as low as 1s. 7d. Power supplies were generally the subject of special contract; and the 1s. 7d. price was fixed in two of these. One was with the Council, who took gas for pumping water. For public lighting the cost of the gas was about 2s. 7d. per 1000 feet. Prepayment meter supplies could be charged 10d. extra where a meter and fittings were supplied by the Company, and 1s. where a gas-stove also was fitted. These prices were all very low. There was a differential rate of 5d. per 1000 feet which could be charged outside the urban district. The character of the demand was important; and he could point out that a very large proportion of the gas was sold to mills and works for the purposes of power. The result was a very high proportion of gas sent out in the day time. It was, in fact, unduly large. In the present year, no less than 80 per cent. of the whole load during the summer had been supplied in the day hours—from 6 a.m. to 6 p.m. Even in the winter during the light hours 50 per cent. was supplied. These proportions accounted to some extent for the low prices charged, and also had a material effect on the sizes of some portions of the plant. The present consumption was about 32 millions; and the demand was increasing and likely to continue to do so. To prove this, he quoted several agreements lately entered into for large supplies of gas. The concern had been most efficiently managed. Tables had been agreed by the accountants for the parties; and these showed that the quantity of gas made last year was nearly 28 million cubic feet, the quantity sold per ton of coal carbonized being about 10,700 feet. Each year since 1907 there had been an improvement in this respect. The unaccounted-for gas had steadily decreased, until last year it amounted to 5 per cent., and for the first half of this year to 4 per cent. So far as residuals were concerned, the results were equally satisfactory. The Company was originally constituted under a deed of settlement in 1840; the capital originally subscribed being £1730. For some years there were no dividends; and from time to time the capital was increased. In 1865, a few shares were sold at auction by the Company, and the premiums realized were put into the business. In 1887 the paid-up capital was something over £3000; and in that year further shares were sold at a premium. The same thing happened in 1897 and 1902, when the capital was increased to £5500. In fact, no less than £2477 remained in the business by way of premium. There was a reconstruction of the Company in 1909, and a new concern was formed, called the Ashborne Gas Company, Limited, with a capital of £20,000. A careful valuation of the works was made, and it was found that the capital value of the concern was upwards of £20,000. It was thus perfectly manifest that, the share capital paid up in 1908 being only £5000, the full interest of the shareholders was not thereby represented. The effect was that the shares in the old Company were surrendered, and for every £10 so surrendered, four £10 shares in the new Company, credited as fully paid up, were issued. The valuation was made by the Manager and the Directors. He did not know for how many years the Company failed to pay a dividend, but 6 per cent. was divided in 1860. In the early seventies this was increased; and in 1887 a dividend of 10 per cent. was reached on the capital of £3000; and this rate was paid continuously up to the reconstruction. In 1909, after the reconstruction, only 4 per cent. upon the increased capital appeared to have been paid; and this was continued until 1911, when 8 per cent. free of income-tax was paid. Last year the full dividend under the sliding-scale—9 per cent., less tax—was paid. The Company considered it was desirable to obtain parliamentary powers, and the Act of 1911 was obtained. An agreement was entered into between the parties, and a purchase-clause was inserted, in accordance with which the Council obtained their Act. This provided for arbitration under the terms of the Lands Clauses Act. It was stipulated, however, that "any arbitrator or umpire (as the case may be) shall not, in assessing the amount to be paid by the Council to the Company, have regard to the fact that the Company had obtained the Act of 1911, but shall fix such amount as if that Act had not been passed." Thus the undertaking was to be purchased on a non-statutory basis—unlimited as regarded dividends, price, and statutory provisions. A fixed sum for costs and expenses had been agreed upon between the parties. Certain additional sums had to be paid by the Council; but these were not matters for the tribunal. Really, the only three matters now open between the parties were the sum in gross for the undertaking, the cost of winding-up, and certain capital expenditure which had to be paid in addition to the sum mentioned. As to the scheme of valuation, the accounts for 1912 were taken, and certain adjustments made. The net revenue (profit) was £2037. Owing to the coal strike, it was not a normal year; and this had to be taken into account, for there was dear coal and less gas used. Then there was the profit subsequently to be made under the three agreements to which he had referred; and having regard to all the circumstances, the Company asked the tribunal to accept the figure of £2200 more or less as the maintainable profit. There would have to be added the profit on fittings; and beyond this the Company asked, not for the customary 10 per cent., but for 5 per cent. The multiplier they put forward was 25 years' purchase, and in the case of fittings 5 years. After allowing for surplus works, and deficiencies in plant, the capital sum which they said was the value of the undertaking was £59,833.

The Evidence.

Mr. *E. H. Stevenson*, examined by Mr. Jeeves, said he had visited Ashborne, and was familiar with the local circumstances, having acted for the Company in the promotion of their Bill in 1911. The area of the land to be transferred was just over an acre. The Company had other land, on which they had built cottages; but the Council did not want this. The works themselves were excellent, in very good condition, and had been maintained in thorough repair. The coal store held about 260 tons, which was not quite a month's supply in mid-winter. The retort-house was much larger than required for the present consumption; and there was room in it for at least two more settings of eight. There were now three settings; but one was not hitherto used. It would, however, be partially in operation this winter. The retorts were easily equal to 8500 cubic feet per day each, and at a push 9000 feet. As the undertaking increased, further condensing power would be required; but with a very small expenditure the works could be extended up to a sale of 40 to 42 million feet a year. The exhausters were well housed, and were equal to three times the maximum day's make of last winter. The scrubbers and washers, too, were very ample. As to the purifiers, the way in which they were worked was poor; but with the reconstruction of the connections and valves, they could deal with three times the make of last winter. The arterial mains throughout the district were ample for the undertaking. The present holders, having regard to the proportion of gas sent out in the daytime, were large enough to deal with a sale of 40 million feet a year. The works were well equipped with stores, workshops, &c. The leading main from the works was 8 inches in diameter; some 60 per cent. of the mains were 4 inches and upwards; and over 80 per cent. were 3 inches and upwards. The gas sold per ton of coal carbonized showed an increase from 9740 feet in 1907 to 10,684 feet in 1912. In the last two or three years, the progress of the undertaking had been rapid; and this seemed likely to continue for some time. He had prepared a table showing the charges for gas of small undertakings in Derbyshire; and Ashborne with 2s. 11d. per 1000 feet was the lowest. The increase in consumption in 1911 over 1910 was 7·76 per cent.; while the next year (which was interfered with by the coal strike, when consumers were asked to be careful) there was a gain of 5·38 per cent. Comparing the first nine months of this year with the corresponding period of 1912, there was an increase of 17·75 per cent. It was not only a new factory of Nestlé's which was responsible for this.

Mr. Harry Jones: Of course, the increase is on the lower priced and less profitable gas?

Witness said some of it was and some was not. Further examined, he said his valuation started with the profit for 1912 of £2037. From this he deducted profit on fittings £42, and deficiency in amount paid for repairs and renewals £129, leaving £1867. To this he added for deficiency in quantity of gas sold in consequence of the coal strike £52; and for additional consumption, as per new agreements, by factories and general consumers, £274. This gave a maintainable profit of £2193, which, at 25 years' purchase, equalled £54,830. Adding five years' purchase of the £42 profit on fittings, £208; 5 per cent. compensation for disturbance, &c.; and £2214 for surplus works, deferred for an average period of four years on the 3½ per cent. table, £2033, he arrived at a valuation of £59,823 for the undertaking. As to repairs and renewals, in the account year the Company showed that they expended on works and mains 3·3d. per 1000 cubic feet sold; and to this he thought it proper to add another 1·2d. This brought the total amount for repairs and maintenance to 5·58d., which he considered a very reasonable figure for the undertaking. In fact, it was more, apparently, than they had ever spent, and yet the concern was efficient. He suggested 25 years' purchase, because he found these shares had for some considerable time been selling far above the ordinary price of shares. He arrived at his figure for surplus works by assuming that the valuation was based on an assured sale of 32 million feet a year, whereas the works would make sufficient gas to sell 40 million feet a year, with a small outlay.

Cross-examined by Mr. Honoratus Lloyd: A very large proportion

of the houses—perhaps between 75 and 80 per cent.—were supplied with gas. Many more buildings must be erected. The progress during the last three years was due to businesses coming into the town. A fair capital to start works in a place like this would be £700 to £750 per million cubic feet of gas supplied; but it would not be fair and reasonable that the Council should buy the profits of a prosperous undertaking at this rate. The station governor could not be too small, when the lowest pressure in the district at the lowest point was 24-10ths. It would be an absurdity in a Company like this to put down 9d. per 1000 feet for repairs and maintenance. No one, even in works which had not been properly maintained as he said these were, spent more than 6d. per 1000 feet year in and year out on repairs and maintenance. The rest was an expenditure on capital account. The 5·58d. allowed everything that was necessary for renewals, whether from obsolescence or from being worn out or burnt out. The amount actually subscribed in cash to the Company was £7477. Whatever other value there was in the Company had been built up out of profits. Parliament said all the funds were to belong to the Company; and he did not think he was entitled to make any allowance for the working capital of £1700 being taken out of the concern. If Parliament had said the Company were to hand over the working capital, probably the claim would have been the same. Witness was then questioned as to the effect of the new factory supplies on the claim.

Mr. HUTCHINSON said he had omitted to state that the Act defined the undertaking as including everything held and enjoyed by the Company at the date of the transfer of the undertaking—with certain exceptions.

Mr. HARRY JONES remarked that he had rather wondered why they were travelling into 1913.

Cross-examination continued: He claimed 5 per cent. for disturbance because he considered this was sufficient to compensate every possible loss by re-investment.

Re-examined: There had been no complaints as to insufficiency of pressure.

The UMPIRE: Can you tell me to what extent surplus profits have been put into the concern?

Witness: To the extent of something over £15,000.

Therefore a purchaser knew that he was buying something more than his share of the £7500 which had been subscribed. He was buying reserve profits which had been accumulated during those years?—But it had all been expended on capital purposes.

Sir CORBET WOODALL: The purchaser would give a very much better price for stock secured with a very large accumulation of undivided profit than he could for one where the profit had been divided to the full?

Witness: Your share of profit is secured by the use of a large amount of revenue which is employed as capital.

Second Day.

Mr. *H. G. Harrison*, who had been Manager of the Company since 1898, examined by Mr. JEEVES, said that immediately after his appointment he went into the question of the efficiency of the works in general; and on his advice the Directors decided to go in for a scheme of extension and renewal, to make the plant equal to 30 million cubic feet per annum, or double the make at that time. This was gradually carried out, with excess in some portions of the plant. The plant was ample for this year's probable make of 32 millions; and there would still in some parts be a considerable reserve. The alterations had been carried out partly by the issue of new shares, partly from accumulated profits, and partly by the issue of mortgage debentures. The plant in general was in a very efficient state. The condensers, judged in comparison with the rest of the plant, would perhaps be considered the least satisfactory portion. There were three beds, of eight, seven, and six retorts respectively; and the production per mouthpiece had reached over 9000 cubic feet per 24 hours. Taking it at 8500 feet, two benches of eight and seven retorts were until now equal to the maximum demand. The growth the Company had had in consumption had been very largely on the day load. There had been a constant and steady increase. In 1898, the maximum amount of gas sent out in 24 hours was 80,000 cubic feet; and in 1912, it was 120,000 feet—or an increase of 50 per cent. This year he expected an increase of over 4 million cubic feet, as compared with last year. The mains were sufficient to maintain a good pressure in all parts of the district; and a large proportion of them were equal to a further growth in consumption. There was a shortage of houses in the town. The Company had just secured two large power consumers. Since the Council obtained their authority to purchase, the Company had not attempted to push their business in any way. The Directors were reluctant to incur capital expenditure; and plenty of business had been coming of its own accord. The Company had never divided all the profits, but had gradually been spending money in building-up the business out of profits. When the capital was increased, the Directors satisfied themselves that it was more than represented by the outlays up to that date.

Cross-examined by Mr. HONORATUS LLOYD, witness said he had not with him a copy of the valuation which he had made at that time; and the experts now engaged in the case had not seen it. In 1911, the output was nearly 27 million feet; and when before Parliament he said that, if they had any material increase over this, they would require additional storage. He had, however, since then further considered the matter. The Company had spent all that had been necessary during the last few years to keep the works in proper order; but as time went on, it might be necessary to spend more. In the coal strike year, they obtained better prices for residuals; but, of course, they paid more for coal. They were now getting the same prices for residuals. For tar they were getting a better average price, as they were selling more to local authorities. In 1912 they paid £1806 for coal, or 15s. a ton delivered at the works; while this year the price was 16s. 3d. per ton. It was the general experience this year that, while the price of coal had gone up, the price of residuals, taken as a whole, had gone down. There were several factories in Ashborne; and the inhabitants would not agree that it was "merely a small market town." There was no electricity supply. He had had no trouble with his purifiers. The storage he reckoned at 110,000 cubic feet; and they had had no difficulties in this matter.

The UMPIRE: With your experience as a gas engineer, do you say 110,000 cubic feet storage is enough to deal with an output of 32 millions a year under the conditions which exist where you are?

Witness: I do.

Cross-examination continued: Based on 140,000 cubic feet as the 24-hour winter's load, he would say the storage was sufficient. The station-meter was of a capacity of 7000 cubic feet per hour. The covered coal-stores were not equal to holding a month's supply in winter. He did not think there would be room to put up another gas-holder on the present site. It might be preferable to have a covered-in oxide revivifying shed; but they had had no trouble at the works in this respect. There was not a safety-governor on the works; and he did not think that works of this size usually had one. The Trent Fishery Board had tried to make trouble about the pollution of a stream by effluent from the sulphate plant; but they had no evidence. The average weight of charge in the retort was 3½ cwt.; and the usual duration was six hours. They were now charging the top retorts five times per 24 hours.

Re-examined by Mr. HUTCHINSON: The valuation he had made, and which had been referred to, could be obtained, and placed at the disposal of the tribunal. The retort-house was large enough to add another bench; but the existing retorts were not yet worked to their full capacity. In ascertaining the amount of storage required, the proportions of the day and night load were important. Looking at the results of his working there was no defect such as would be shown if there were deficient storage. They were now getting slightly better carbonizing results; and he hoped this would counterbalance the extra price being paid for coal. The make per ton had been going up, owing to improved working. There were a number of gas-engines in use over the district. Though the number of meters might not recently have increased largely, the amount per meter had been showing a substantial increase. In the winter there had generally been coke coming into the district from outside sources.

Questioned by Sir CORBET WOODALL, witness said if the retorts were fully used, they could make 40 million cubic feet of gas. He had stated that there might be a larger expenditure per 1000 feet in future for repairs and renewals. When the plant became worn, it would demand more outlay on it. But he did not see anything in an increased consumption which should cause, by reason of the increase, a larger expenditure on repairs and renewals. There were three holders—one of 70,000 cubic feet capacity, and two of 20,000 feet each. The smaller ones were kept full, and were merely emptied from time to time, so that practically the work was done by the larger holder.

Mr. *John Lister*, the Chairman of the Company, in answer to Mr. JEEVES, said the statements made by Mr. Hutchinson in his opening were quite correct. The basis of the reconstruction was that the shareholders received four shares for each one; and before the scheme was entered into, careful consideration was given to the value of the undertaking. In every way the Board had kept expenses down. With one exception, alterations in the price of gas had been always downwards. Of the total of 2000 shares, about one-third were held by trustees. In the case of two wills of which he had personal experience, the trustees were directed to hold the gas shares.

Mr. *Robert Williams*, the Solicitor to the Company and Clerk to the Urban Council, produced a list of share transfers. The table was divided into three portions. One was before reconstruction, the next after, and the third after incorporation as a Statutory Company. This showed that the yield to the purchaser varied from £2 5s. 8d. in 1912 up to £4 3s. 4d. in 1907. The yield to the purchaser after the reconstruction did not differ very materially from the yield before that time. On the average, it was slightly less. With the exception of one special transaction in 1912, after incorporation the yield to the purchaser was not materially different from what it was after reconstruction in 1909. The total number of shares transferred after the reconstruction in 1909 to the present time was 134.

Mr. HONORATUS LLOYD pointed out that within a few months, early in 1909, the price per share jumped from £24 to £40, and that the buyer who paid £40 just on the eve of the reconstruction in that year subsequently obtained £40 of scrip.

Mr. *C. H. Cowlishaw*, the Chairman of the Uttoxeter Gas Company, replying to Mr. JEEVES, said he had a list giving particulars of sales of £5 ordinary shares in his Company between 1904 and September, 1913. The prices per share varied from £10 15s. to £13 5s.; and the yield per cent., from £4 3s. to £4 19s. 5d. During the period named, the dividend had been increased from 10½ to 11 per cent. Most of the shares had been sold by public auction. Under the Articles of Association, no one could hold more than sixty shares in the Uttoxeter Gas Company. For 7 per cent. shares people had paid at public auction £9 10s. per £5 share.

Mr. *W. A. Schultz*, examined by Mr. JEEVES, said he had inspected the books of the Company, and prepared a statement of accounts. In the form now submitted these were agreed with Mr. Cash, with the exception of the quantity of gas consumed for public lighting. This adjustment might bring the price charged up from 2s. 7d. to 3s. 6d. per 1000 cubic feet.

Cross-examined: He had had experience of the raising of money for gas undertakings, and would say that a fair yield to accept nowadays would be from £4 15s. to £4 17s. 6d. on a similar security to this. There might be no difficulty in getting 5 per cent. in perfectly safe undertakings. The market at the present time for shares of this kind was a very poor one.

Mr. HARRY JONES: It is well known that gas securities have gone down, like Consols, but not quite in the same degree.

Mr. HUTCHINSON: A local market and local interest will affect the value.

Mr. *Henry Woodall*, examined by Mr. HUTCHINSON, said he had visited Ashborne and made himself acquainted with the works and the district, to enable him to prepare a valuation of the whole undertaking. The supply of gas was satisfactory. Until recent years, the business had not grown very rapidly; but lately there had been greater progress, and this year there was going to be an increase of about 17 per cent. The price of 2s. 11d. per 1000 cubic feet was lower than that charged

by any similar company in Derbyshire. It was really a very low price. From the circumstances already explained, he would not call it at all a saturated district, with gas at this price. The works were in very good order, and certainly well up to the present output. He agreed that only a small outlay would be necessary to provide for an increased output. He had made a structural valuation, which amounted to £20,982, or practically the same as that of Mr. Stevenson. He had also compiled a table of excess works, which he valued at £1129. Something must be done to alter the purifiers, to enable them to be used as a set of four boxes. In this way, he arrived at a net value of the excess works of £1075. There was land on the other side of the road on which a large gasholder could be built as required. In fact, there was sufficient land to provide for all the extensions that had been mentioned during the cross-examination of Mr. Harrison. He had taken 5·58d. per 1000 cubic feet sold for repairs and renewals of works, mains, meters, and stoves. The works were in an excellent condition, as were also the mains, as shown by the small leakage. Having regard to the fact that so far the evidence was that the working throughout in every department was satisfactory, the money actually spent on repairs and renewals had been sufficient. Probably a little more had been spent on repairs than was shown in the accounts. The capital was reasonable. Taking the estimates of output for this year as correct, it would be £700 per million cubic feet. The valuation of the undertaking which he had prepared agreed for all practical purposes with that of Mr. Stevenson. The figure which he arrived at as the total valuation was £58,731. He had added for the extra revenue which would be purchasable at the date of transfer (as the result of contracts entered into) £270. With regard to the number of years' purchase, he had based his 25 years' largely on precedent. No valuer he knew of had ever asked a lower figure than that for an undertaking of this sort. He had first taken into consideration the fact that the business was a growing one, and the profit was maintainable. The market price of gas shares was not a reliable guide in cases of this sort. One invariably had to pay more for a complete undertaking than for a batch of shares. For fittings, he allowed five years' purchase. To the capitalized value of £54,910, he added 5 per cent., for disturbance, cost of re investment, &c. The figure he had generally adopted for this was 10 per cent. This gave £57,655, and he added the surplus works, making £58,731. This was the sum which he thought ought to be assessed by the tribunal as the value of the undertaking.

Mr. HONORATUS LLOYD (in cross-examination): I suggest the real capacity of the works is about 28 million feet, and that they are being pushed hard now?

Witness: I cannot agree with that at all.

Cross-examination continued: It was quite possible the shareholders could re-invest their money in equally well-secured companies to pay over 5 per cent. Whenever an undertaking was acquired, a very much larger sum had to be paid than simply the market price of the shares. As to the 5 per cent. for disturbance, loss on re-investment, &c., he had put this in because he thought the 10 per cent. usually inserted was too big a figure. Regarding repairs and maintenance, he thought that the biggest figure he had ever taken was 6d. Many undertakings charged a larger figure; but, of course, it included depreciation, which was not included here. In this case, it must be remembered, there was no machinery.

Re-examined: The average of the corporations given in "Field's Analysis" was 5·74d. per 1000 cubic feet sold for repairs and maintenance—the towns ranging from Birmingham to Salford. In adding 1·2d. to the amount that had been spent in recent years, he was acting quite fairly.

The UMPIRE: Supposing you have storage capacity which is rather less than you require in periods of great demand, can you eke that out economically, if you have retort capacity available, by increasing the number of retorts you are then working? I mean, if you have retorts available is it as economical to fire-up these retorts as to provide additional gasholder capacity?

Witness: I should think not. Gasholders are an expensive part of the plant; but it is uneconomical to partially fire-up retorts and keep the benches under slow fire, if with a little extra storage you could avoid doing it.

Would it be cheaper to do that on an emergency than to provide permanent gasholder accommodation?—It would be difficult to work out, because you do not know how long you would have to keep your retorts for the emergency under slow fires, so as to bring them into use at a moment's notice. I think it is much wiser to have a fairly good storage. Many undertakings have worked for years with smaller storage than this one has.

Mr. HARRY JONES: Can you give us any out of your numerous companies that have succeeded in doing repairs, &c, at 5½d. per 1000 cubic feet?

Witness: No. If you can do it, I think it is better to spend more on the depreciation of these articles.

Can you give us any instance from your own works where the gasholder accommodation is much under 100 per cent. of the day's consumption?—I could give you some.

This concluded the case for the Company.

Standard Meter Company, Limited.—This Company has been registered with a capital of £20,000, in £1 shares, to carry on the business of manufacturers of and dealers in gas, electric, and water meters, and all apparatus and things required for, or capable of being used in connection with, such meters. The first Directors are Messrs. F. and H. T. Thorp, of Whitefield, Manchester, where the registered offices—the Company's Victoria Works—are situated.

Stratford-on-Avon Water Supply.—The Stratford-on-Avon Corporation are proposing to improve their water supply, and for this purpose they will construct a reservoir to hold 100,000 gallons. The water to be pumped into it will be used for sewer flushing, street watering, and general sanitary purposes, and will, it is estimated, result in a saving of from 40,000 to 50,000 gallons daily in summer to the ordinary water supply, which it is intended to keep solely for domestic use. Hitherto in the summer season 25,000 gallons daily have been taken from the ordinary supply for street watering and other purposes.

GAS SUPPLY OF THORNABY-ON-TEES.

Proposed Independent Works.

It was mentioned in the "JOURNAL" for the 7th ult. that a project is on foot for the erection of independent gas-works for Thornaby-on-Tees, which is now supplied by the Stockton Corporation. The subject was under discussion at the meeting of the Stockton Town Council last Tuesday.

Mr. T. DOWNEY, in drawing attention to the matter, said he noticed that the Gas Committee had decided that they could not see their way to sending a deputation to the Thornaby Corporation on the terms mentioned in a resolution passed by that body, to the effect that they were willing to receive a deputation if the Corporation were prepared to reduce the price of gas in Thornaby to the Stockton basis, and hand over a proportionate share of the profits. He was not satisfied at leaving the matter where it had been left by the Committee, and therefore he proposed the addition of the following words to their decision: "To secure the continuance of the friendly relations between the two boroughs, and also to avoid the cost in connection with any parliamentary proceedings, suggest the advisability of a joint meeting to discuss the matter fully, without any previous undertaking being given." He suggested that this would keep open the door for negotiations; and if these took place, the Gas Committee must be prepared to rid their minds of such fallacies as that the price of gas must be so fixed that there would be a certain sum per annum available for the rates of Stockton. Further, they must remember that it was not at all incumbent upon outside consumers to have for ever to pay the Stockton Corporation much more for gas than the Stockton consumers. Mr. Downey then proceeded to show the extent of the gas consumption in Thornaby. In 1908, it was 45¼ millions; in 1909, 41¾ millions; in 1910, 43¾ millions; in 1911, 46 millions; and last year, 67½ millions. He added that it was obvious that if any of them were engaged in a commercial undertaking, and were selling a product similar to gas, and had an opportunity of keeping a customer who helped them to reduce the prime cost of the undertaking, they would strive by all means to do it.

Mr. R. COHEN seconded the proposition.

Mr. SCAIFE supported it, remarking that he did not think they would lose their dignity in going over to Thornaby. It would not be to their interests if they were to lose Thornaby as a customer.

Mr. DOUTHWAITE suggested that a mistake had been made in not treating Thornaby as being in earnest in the matter.

Alderman HARRISON (the Chairman of the Gas Committee) said he entirely agreed with most of the remarks which had been made; and he did not object to the proposed addition to the resolution. He should be extremely sorry if Stockton lost Thornaby. It was all very well for the Thornaby Corporation to say they could go elsewhere to get gas; but they could not. Parliamentary powers would have to be obtained. He thought Stockton were in an extremely strong position. They were selling gas at a very low figure, and were charging Thornaby very little more than was being paid by the Stockton consumers. He was not prepared to give Thornaby anything unless he thought it was necessary. He would fight if required; but, if possible, he would go the greatest length so as to keep Thornaby a customer. He hoped the Council would adopt the suggested addition, if it would keep the door open for further negotiation.

The proposition was then put to the meeting and carried without opposition.

It may be mentioned that the Thornaby Corporation are being advised by Mr. A. Morton Fyffe, of Nelson, and they have two schemes before them—one for the erection of complete gas-works, and the other for the purchase of coke-oven gas in bulk.

EARLY DAYS OF GAS IN AMERICA.

Interesting Reminiscences.

The holding of the eighth annual meeting of the American Gas Institute in Richmond (Va.) prompted Mr. E. C. Jones, the Chief Engineer of the Pacific Gas and Electric Company of San Francisco, to address to the President (Mr. Walter R. Addicks) a letter, in the course of which he made an interesting statement in regard to the introduction of gas lighting into the city rather more than sixty-two years ago. The writer said: "I am particularly interested in the Richmond meeting for sentimental reasons. The other evening, in looking over an old note-book of my father's, I found drawings and a description of the Richmond Gas-Works, which he built in 1850-1, while Superintendent of the firm of Blake and Darracott, contractors. Among the notes I found the following:

> The first gas made in Richmond (Va.), ten minutes before 10 a.m., February 10, 1851.
> E. JONES,
> Superintendent of the Works,
> Under Blake and Darracott.

This was the first gas made in Richmond; and dear old dad was the pioneer who put up the works, laid the mains, and showed the people how to use gas."

This interesting piece of information occupies a prominent position at the head of an article in the "Richmond Times-Dispatch," referring to the meeting and giving a history of gas both in England and in America, together with a few particulars of the undertaking specially mentioned by Mr. Jones. It is unnecessary to repeat here the oft-told story of Murdoch and his invention; so we reproduce the portion of the article which deals with America. It is as follows:

In America, David Melville, of Newport (R.I.), had in 1806 completed an apparatus by which he lighted his house and the street in front with gas of his own manufacture. On March 18, 1813, Melville secured a patent and lighted mills at Watertown (Mass.) and two mills near Providence with the same illuminant. All this experimenting and

demonstration had been closely watched by enterprising Americans. On Dec. 30, 1815, the "American and Commercial Daily Advertiser" (now the "Baltimore American") published a brief and pointed article on gas, calling attention to the facts that Covent Garden Theatre and some London streets were lighted by gas which the inventors had offered eight or ten years later to the people of Baltimore, who had laughed at the idea. The article concluded with a tart comment: "An American inventor, it would appear, can have little credit in America until he receives the sanction of the people of London." In the following year gas lights were exhibited in Peale's Museum on North Holliday Street, Baltimore, and this building is still standing. [A view of it is given.]

When the museum was discontinued, the building was for several years used as a City Hall, and later for a public school. It is now occupied by the Baltimore City Water-Works. The demonstration by Mr. Peale resulted in the formation of a company for the manufacture of gas in sufficient quantities to light the entire city. It began operations in 1821. Baltimore now has in the neighbourhood of 110,000 meters, and it requires about 600 miles of mains to supply the city. Add to this the services, and the total quantity of pipe in use would probably extend straight across North America.

In America the cities that first used gas were Cincinnati, Baltimore, Newport (R.I.), New York, and Boston. It might be said that gas was originally made of the resin of the pine; and this crude method of manufacture made it very expensive. It may also be said that in its distribution the mains were made of the hollowed trunks of trees, and it has been stated, and not denied, that, when first introduced in some of the homes, the barrels of old guns were utilized for pipes in the interior of the buildings. As late as three years ago, in excavating in New York for the subways, a section of the old wooden main, with a section of the new iron main joined to it, was unearthed.

The Richmond Gas-Works were built by the city in 1850, and have been owned and operated by it ever since. The city was lighted on Feb. 22, 1851, and the charge at that time was $4 per 1000 cubic feet. At the present time it is impossible to locate any data referring to any house now standing which was among the first to use gas there.

Gas was introduced in New York in 1823. The New York Gaslight Company—the first to furnish gas in the city—at the outset sold its product at $10 per 1000 cubic feet. The first house to be lighted by gas was that of Samuel Leggett, the original President of the Company, who lived at No. 7, Cherry Street. [A view of the house is given.] At that time Cherry Street was a fashionable neighbourhood, and now the site that was occupied by Samuel Leggett's house, which was only a stone's throw from that of George Washington, is occupied by the pier of the Brooklyn Bridge, located on Manhattan Island.

When the New York Gas Company was organized and started its operation, the city was confined to the lower part of what is now the borough of Manhattan, on Manhattan Island. The upper part of the island comprised Yorkville, Manhattanville, Harlem, and Carmansville. There are now in the city of New York about 865,000 meters in use; and the gas that flows into them is supplied by about 1800 miles of mains and about 1500 miles of service-pipes. It takes almost 1,000,000 tons of coal every year to furnish the gas supplied to consumers in Manhattan and the Bronx; and it is in New York that are to be found the largest gas-mains in the world—mains that measure 5 feet in diameter.

BAD LIGHTING ARRANGEMENTS AND EYE-STRAIN.

The remarks made by Professor Lewes, in the course of his paper on "The Lighting, Heating, and Ventilation of Factories and Workshops" at the National Gas Exhibition [*ante*, p. 420], on the effect of bad lighting arrangements on the eyesight, prompted a representative of the "Birmingham Daily Mail" to interview on the subject an occulist in the city, who gave him the following information.

It would be a mistake to suppose that the eyesight of the people was very much worse than formerly. The eyesight of persons working at high pressure in ill-lighted factories might have deteriorated somewhat, taking such operatives as a class; but taking the community generally, the standard of eyesight was pretty well maintained. It was true that far more persons—especially children—wore glasses than formerly, and that there was greater pressure of work at the eye hospitals. But these circumstances, it was suggested, meant that eye defects were now attended to which years ago were neglected, or did not receive treatment until a person had reached more mature years. The frequent use of glasses meant, therefore, that greater care was being taken of the vision, and not necessarily (except in certain trades) that it was more faulty.

It was pointed out that the lighting arrangements of buildings had an important influence on the eyes. What was perhaps more important than the actual lighting was the proper disposition of the lights. It was essential for the public well-being that the illumination fell not upon the employee, but upon the work upon which he or she was engaged. More injury was done through insufficiency of lighting than by excess of illumination, by reason of the eye-strain that was caused. On the other hand, vivid bright light often had a prejudicial effect on the eyesight of workers who were not physically strong. In a simple way, such light might be toned-down by shades of soothing colours, such as blue and green, but where excessively bright illumination was essential for business, protection could be afforded to the individual by the wearing of green or slightly tinted glasses. An excess of light might cause retinal fatigue, and ultimately partial blindness; and if this occurred, prolonged rest in a darkened room might become necessary. The opinion was also given that *incandescent gas was less hurtful to the eyes than electric light, on account of the ultra-violet rays of the latter.*

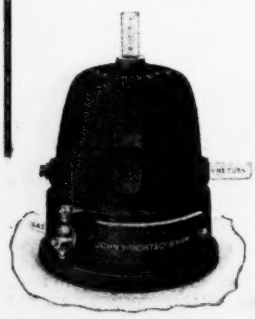
The herald of a great "run" in Gas Boilers.

THE 50/- CIRCULATOR

AVERAGE PRICE OF OTHER MAKES £5.

It is this great difference which has already started the "RUN."

The "B.T.U."



As to the EFFICIENCY of the "B.T.U." Circulator, we are satisfied; you will be equally so when you have tested it.

The "B.T.U." Circulator is an evolution of our popular "GARAJO" Boiler.

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PROJECTED "PALACE OF LIGHT" AT NOTTINGHAM.

The initial step in the venture which is designed to make Nottingham next year the centre of an exhibition appealing for universal support, was taken last Thursday, when, with civic ceremony, the first turf was turned on land upon which the buildings are to stand. Much is expected from the undertaking, which is to include as one of its principal features a "Palace of Light," in which various systems of illumination by gas, electricity, acetylene, and petrol are to be practically exemplified. Nottingham has had in the past some not entirely acceptable experiences of exhibitions upon a more limited scale. These have been mainly of a trading character; but the present scheme, with the Duke of Portland, the Lord Lieutenant of the County, as Chairman of the Executive Council, is upon an entirely different and altogether higher plane—the speculative element giving place to features which, arranged upon international lines, are designed to embrace commercial products both of British and foreign origin. Naturally it is intended, upon the strictly local score, to make the display representative of Nottingham's chief industries—lace and hosiery; but of the other elements in the programme, those which relate to the display of lighting apparatus occupy a conspicuous place. The participation by the Chairman of the Gas Committee in the initial proceedings indicated the desire to afford all possible assistance to the project from this important branch of the Corporation work; and the results, with the co-operation of many of the leading manufacturers of lighting appliances in different parts of the country, promise to be of an interesting nature. The London Syndicate promoting the scheme, which has made no appeal locally for funds, has been fortunate in securing from Sir Hervey Bruce a picturesque site of 40 acres abutting upon the ample riverside esplanade which forms one of Nottingham's main outdoor attractions. With large industrial and mining centres within such easy reach, it is anticipated that during the four months over which the exhibition will extend—from May 28 to Oct. 3—three or four million visitors may be specially attracted to the city to view the display, which it is claimed will be the largest that has been seen in the provinces for years. The ceremony last Thursday was performed by the Mayor of Nottingham; and a luncheon was given at the Victoria Station Hotel.

GALVANIZED IRON FOR WATER-PIPES.

Dangers Attending its Use.

Attention has lately been drawn by correspondents in the "Sanitary Record" to the difficulties which sometimes obtain in the use of galvanized pipes and cisterns in water distribution. Writing on the subject in the issue for the 31st ult., Dr. Samuel Rideal said: "The subject requires very careful consideration at the present time, as in recent years the methods of galvanizing have undergone considerable change—in my opinion, for the worse; and it would seem desirable that a new standard specification for this class of work should be formulated. In my own practice, I have from time to time met with cases of water supplied to consumers with appreciable quantities of dissolved zinc in them. This orginates through faulty work, as in most cases a pipe effectively coated with zinc is not attacked by normal waters. The problem is one of an electro-chemical nature, which ought not to be difficult to standardize." In the same number, a water-works engineer wrote as follows: "My experience has been that the duration of the galvanizing of iron pipes has extended over a few years only, and that the value of the process has been greatly overrated. Let anyone take up a galvanized pipe which has been in use for about three years, and he will, under most average conditions, find that the galvanizing has disappeared, and that, as a result of internal corrosion, the waterway has been seriously reduced. It is almost superfluous to ask as to where the zinc which formed the internal coating has disappeared when the water is used for potable purposes. Zinc produces symptoms of irritant poisoning when absorbed in the system; and an investigation into the whole subject appears to be highly expedient and of very great importance."

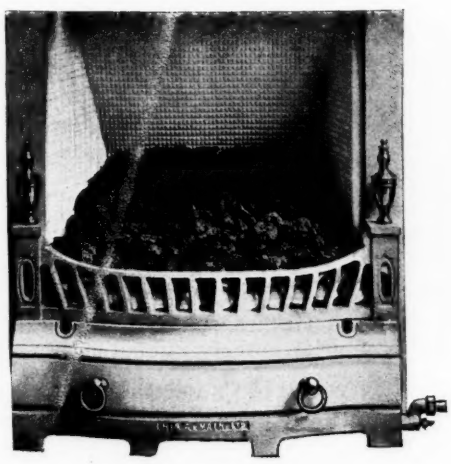
In the current issue of our contemporary, Mr. J. E. Webb expresses the opinion that galvanized iron to resist corrosion is a failure for water-pipes, owing to the fact that cutting or bending the pipes at once destroys the galvanized surface, and there are no practical means of replacing it. Further, the crystallization of the iron by the process of galvanizing lessens its strength and considerably lowers its rust-resisting qualities when once denuded of its zinc coat. Mr. Baldwin Latham, in a short letter, says he considers it is undesirable to have zinc in contact with water, as exactly the same action takes place as with water which is liable to cause plumbism by the use of lead pipes. He has seen galvanized iron pipes pitted completely through in certain soils in the course of two or three weeks after being laid; and it is not his practice to use them.

POOLE CORPORATION WATER SUPPLY.

A Serious Breakdown—Increased Storage Needed.

A breakdown of the machinery at the pumping-station of the Poole Corporation at Corfe Mullen, and a consequent diminution and temporary cessation of the water supply, have been investigated by a Special Committee, whose report, together with that of the Water Committee, was considered at a meeting of the Town Council last Tuesday. The engines and pumps are in duplicate; and the breakdown occurred at the end of the summer, when both pumps had been kept working for some time. One was stopped for repairs, and the other broke down. The Special Committee found that the machinery was generally in a bad condition owing to a disregard of the Manager's

The Value of the "ST. NICHOLAS."



The "St. Nicholas" is an efficient Gas Fire which becomes an integral part of the coal grate into which it is fixed, and which, owing to its unique resemblance to a glowing coal fire, does not offend the most æsthetic susceptibilities.

Its sales have been tremendous, and its value in introducing gas as a means of heating into the homes of the more conservative section of the British Public cannot be over-estimated.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 8, Exchange Place, Donegall Street, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

instructions by the Chief Engineer. They therefore thought it advisable to request him to send in his resignation. This he did.

A Sub-Committee had been appointed to consider the advisability of increasing the resources of the Corporation for storing water. At present the total capacity is 1,670,000 gallons. For the year ended March 31, 1909 (the first complete year of the Corporation taking over the water-works), the consumption was 156,270,664 gallons; and the demand increased year by year, till that for the year ending in March last was 262,409,860 gallons, or an increase of 68 per cent. The maximum daily consumption in June was 1,048,400 gallons. The Sub-Committee said it was plain, from these figures, that the storage was insufficient to secure a reasonable margin of reserve in cases of stoppage of pumping or fracture of the rising main, without taking into account the increasing consumption due to the growth of population. They considered that there should be storage to provide for a supply for at least three or four days without resorting to pumping. They thought it sufficient to call attention to the inadequacy of the storage, which they said must be dealt with if the undertaking is to be placed on a safe basis. The Water Committee resolved that the Council be again recommended to obtain the advice of a competent expert as to what steps should be taken to place the undertaking in a satisfactory condition, and to make provision for the growing demands of the district; and that it should be left to the Committee to engage the expert and arrange terms with him.

At the meeting of the Council on Tuesday, the Chairman of the Water Committee (Alderman C. Carter) said he had recently received a telegram to the effect that both engines were working satisfactorily; and it was to be hoped that the machinery would now run without further trouble. He added, in regard to the storage question, that he thought the figures submitted by the Special Committee were sufficiently convincing to show that something ought to be done. He moved the adoption of the report, and strongly urged the Council to call in expert advice. The Mayor, however, moved, as an amendment, that the clause on this matter should be referred back to the Committee. Mr. Hudson contended that neither the ratepayers nor the whole of the Council, nor even some members of the Water Committee, realized the town's precarious position in connection with the water supply; and he submitted that it was time the situation was thoroughly understood. The reservoir capacity was not more than half-a-day's supply during a time of drought. He wished to insist on independent advice being obtained as to their position in case of a breakdown, as at present they were not safe. For the amendment the voting was equal, and it was not carried. The report was then adopted as it stood.

Early last Wednesday morning, a fire broke out at Messrs. W. G. Barker's cinematograph studios at Ealing, and damage to the extent of more than £1000 was done. It is supposed that the outbreak was due to the overheating of some electric bulbs which had been put into a dummy fireplace.

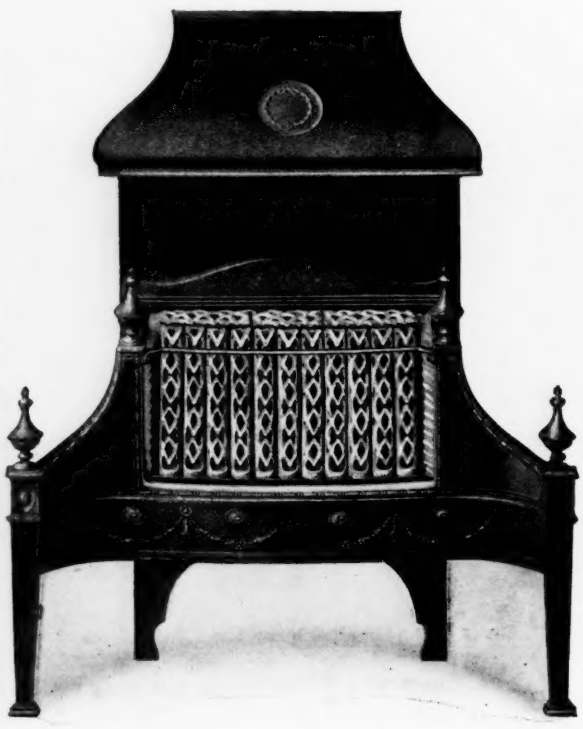
NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

There are several interesting points brought out in connection with the public lighting of Edinburgh in the annual report by Mr. John Gibson, the Inspector of Lighting and Cleaning. During the year ending May 15 last, it is remarked that, in the case of gas-lamps, the Gas Commissioners are only concerned in providing the connection, and this department provides the pillars, fits the lanterns, maintains the lamps, and attends to the cleaning, lighting, and extinguishing. Payment is made to the Gas Commissioners for the consumption of gas and work consequent on providing and removing connections for lamps, and for alterations. There were on May 15 11,772 lamps for street lighting, of which 10,489 were gas, representing 10,551 jets. The number of electric lamps was 1283. During the years from 1909 onwards, the gas-lamps have increased from 10,242 to 10,489. During 1912 and 1913, the number of electric lamps has remained stationary at 1248 arc and 35 incandescent; while for 1913, as compared with 1912, there has been an increase of 73 gas-lamps. The gas is supplied at the rate of 2s. 3d. per 1000 cubic feet, as against 2s. 8d. for private use. These charges showed a reduction from 2s. 6d. and 3s. respectively in the year 1909. As mentioned in the last report, an experiment was then in progress whereby nine street lamps in Rose Street were automatically lighted and extinguished by a clockwork apparatus. Further tests are under consideration; but so far no decision has been come to. The net expenditure of the Lighting Department was £44,708, as compared with £44,591, or equal to an assessment of 3¼d. in the pound.

A thought which has been started by the gas exhibition in London has grown into the suggestion now made that the various gas companies, corporations, and manufacturers of gas apparatus might form a museum of antiquities and modern apparatus in connection with the various technical colleges where gas supply and manufacture are taught. It is, of course, not suggested that old gasholders, purifiers, and such large pieces of apparatus could be installed in the buildings; but small apparatus, such as burners, governors, ancient lamps, models, drawings, books, and, in fact, anything which should be preserved, and which would prove of educative value, might be presented to such institutions, so that the younger men might see the work done by their predecessors, and learn both the failures and successes of early workers in the gas industry. There is no doubt that glass cases and space would be provided by the colleges, and the advantage to the lecturers would be very great; while the fact that the student could examine the apparatus for himself would ensure his understanding thoroughly its working. In many of the industries which are the subjects of lectures at the technical colleges, this presentation of apparatus has already been carried out, while the gas student has been more or less neglected. Another advantage of this arrangement would be that these ancient curiosities



"ADAM," with Back and Hood.

Art and the

Never before have Gasfires been so closely associ-
Series, designed specially to fulfil the requirements
enthusiasm with which they are being received
endorsed by a recent letter from one of our largest

"We consider that the adoption of Gas Heating growing in the way it should have grown in former that time, which was all we had to offer to the comfort and convenience. Fortunately, we are now growing in number—Gasfires which not only satisfy of hygiene. When it is remembered that the class are the very class who can afford to pay big gas bills (if the Gasfires put in are *modern* Gasfires), the is seen to be very strong."

We want everyone to realize that there is a big field with
They are not only artistic in design but you are able to
Throughout, Beautifully Incandescent when burning,

ASK FOR OUR BEAUTIFULLY

The Richmond Gas

Gasfire

Works and General Offices:
London Offices and Show-Rooms:

would be preserved and gathered together in a permanent collection, where they could be examined whenever desired. In view of the fact that, at least in Scotland, the Junior Associations hold their meetings in the technical colleges, the collections would be frequently on view to those who may have passed beyond the stage of attending courses on the subjects. Another thought is that one of the best forms of advertisement which a manufacturer could have would be to supply to the lecturers on these subjects slides indicating the details of the design of their apparatus, so that they could describe in some detail the various points of excellence which the plant contains. The cost would be small in proportion to the advantage, and, as the student would learn to understand the apparatus properly, he would frequently prove a canvasser for its sale, in preference to another maker's manufactures about which he knew comparatively little.

The visit of the Scottish Juniors (Western District) to the Cambuslang Gas-Works on Saturday afternoon next should prove interesting to members, as there is to be seen an installation of Glover-West vertical retorts, which is practically the latest erection of this type of setting, and may be considered the most up-to-date plant of the kind. The full directions for reaching the works provided by the Secretary (Mr. David Fulton, of Helensburgh) on the billet are much to be commended, as for visitors it is sometimes difficult to know the best form of conveyance to adopt.

It will be remembered that Mr. M'Leod, of the Clyde Valley Electric Company, and Mr. Barker, the Gas Manager of Nairn, were to report on electric and gas lighting schemes respectively; and their reports showed an annual profit for electricity of £42 14s., and for gas of £65 17s. 11d. The price to be charged for electric current was to be 6d. per unit for lighting and 3d. for power; while for gas 5s. 10d. per 1000 cubic feet was to be charged. The Town Council, when they had considered these reports, voted as follows: Three for gas, two for electricity, and three for no action. Consequently the matter was delayed, and no scheme has been placed before the electors. At a meeting for the hearing of prospective town councillors, there was much said regarding these schemes; but the failure of the water supply being more urgent, the matter is likely to be delayed still further. It is expected that over £1000 will have to be spent at once to ensure an adequate supply of water. A retiring councillor, Mr. Gall, used some excellent arguments in favour of gas; pointing out that in a summer resort like Dufftown there would be no demand for electric power; so that the plant and the attendant would be doing nothing during six months of the year. "They could not expect people who had oil-engines to put them out and introduce electricity." They might, however, connect up the town's gas, if it were in the mains, and avoid the trouble and expense of oil-engines. This is a further point in favour of gas for Dufftown, as the oil-engines could be very easily and cheaply converted into gas-engines, but must be discarded entirely if electric motors are installed. The latter, with current at 3d. per unit, are not very economical. Provost Grant advocated electricity, and suggested that sewing-machines would be run by it and electric irons used by the ladies [why should they not also use gas-irons, if gas were fitted?], while electric machines would be used for blacking boots and to save the butcher chopping meat. The advocates of electricity must be hard put to it to find reasons for their preference when they can only suggest such petty uses for this commodity. No wonder the meeting laughed at the Provost's suggestions. Dufftown should have its gas-works, and then it will find plenty of uses for gas—for cooking, heating, and lighting.

At the Deaf and Dumb Institute, Glasgow, last Thursday evening, Mr. Alex. Wilson, the Engineer and General Manager of the Gas Department of the Glasgow Corporation, delivered to the members of the Institute and friends a lecture on the "Manufacture and Uses of Gas." There was a large audience. The oral part of the lecture was interpreted by the Rev. John Henderson, Secretary of the Institute. A number of specially prepared lantern views, illustrating the uses of gas for domestic and industrial purposes, were shown; and a cinematograph film illustrating "Gas Manufacture from Coal Mine to Daily Use" was exhibited.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 8.

Sulphate of Ammonia.

During the past week there has been some improvement in the tone of this market, and a small advance has taken place from the lowest point reached lately. The demand has, however, been mainly for the purpose of covering old contracts, as direct buyers have resisted any increase in prices. The closing quotations are £13 1s. 3d. per ton f.o.b. Hull; £13 2s. 6d. per ton f.o.b. Liverpool, and £13 3s. 9d. per ton f.o.b. Leith. There have not been any new first-hand transactions recorded in the forward position; producers' ideas and those of buyers being too divergent to permit business. It is reported, however, that dealers are still willing to sell over the early months of next year at quite a small premium on prompt prices.

Nitrate of Soda.

There is no change in either the tone or the value of this article, and spot quotations are repeated at 10s. 7½d. per cwt. and 10s. 10½d. for ordinary and refined qualities respectively.

LONDON, *Nov.* 10.

Tar Products.

The markets for tar products on the whole are quiet, and business is somewhat difficult to arrange. In pitch, a fair amount of trade has been done during the past week at slightly lower figures. In many instances, distillers have recognized the fall; and it is this slight reduction which has tempted buyers to purchase some quantity. There has also been a fair amount of foreign pitch offering. Benzol, 90 per cent., is still very firm for both prompt and forward delivery. Solvent and

Gasfire.

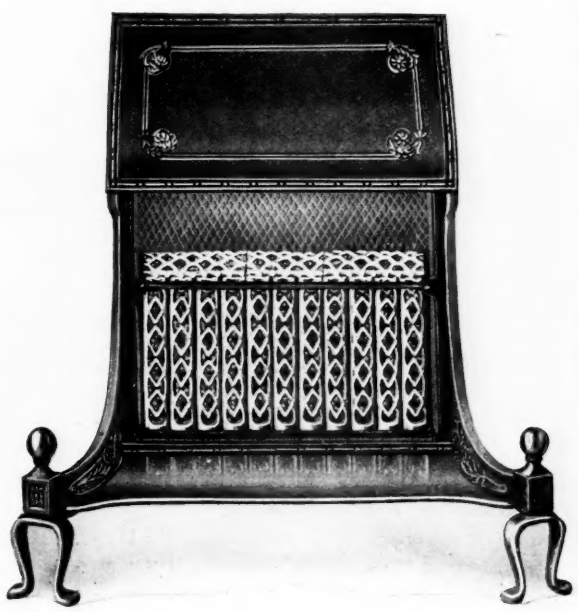
ated with Art as is the Richmond "PERIOD" of present day furnishing and decoration. The by Gas Undertakings throughout the country is Gas Undertakings as follows:—

by the best class consumer was prevented from years owing to the wretched design of Gasfires at person who placed æsthetics before consideration of able to put before such people—and they are steadily the demand of æsthetics, but also that of economy and of consumers to whom well-designed Gasfires appeal for heating . . . and never grumble at the bills case for Gasfires similar to your 'PERIOD' Series

the better-class consumer for the "PERIOD" Series. offer fires fitted with Silent Burner—Interchangeable and of a Radiant Efficiency approaching 60 per cent.

ENGRAVED BROCHURE.

Stove & Meter Co., Ld.,
Specialists,
Academy St., Warrington.
132, Queen Victoria St., E.C.



"RENAISSANCE."

heavy naphthas are unchanged, and business is quiet in both these articles. As to crude carbolic, some dealing has been reported at a low price; and beyond this there is little or nothing doing in the article. Creosote is firm, and the inquiry for the forward position continues.

The average values during the week were: Tar, 28s. 3d. to 32s. 3d. Pitch, London, 41s. 6d. to 42s. 6d.; east coast, 41s. 6d. to 42s.; west coast, Manchester, 41s. to 41s. 6d.; Liverpool, 41s. 6d. to 42s.; Clyde, 42s. 6d. to 43s. Benzol, 90 per cent., naked, London, 1s. 1d. to 1s. 1½d.; North, 11½d. to 1s.; 50-90 per cent., naked, London, 1s.; North, 11d. Toluol, naked, London, 10⅝d. to 11d.; North, 10¾d. to 11d. Crude naphtha, in bulk, London, 5⅛d. to 5½d.; North, 5d. to 5¼d. Solvent naphtha, naked, London, 10¼d. to 10⅜d.; North, 9¼d. to 9⅜d. f.o.b. Heavy naphtha, naked, London, 10d. to 10⅛d. f.o.b.; North, 9d. to 9½d. f.o.b. Creosote, in bulk, London, 3⅜d. to 3½d.; North, 3d. to 3⅛d. Heavy oils, in bulk, London, 3⅝d. to 3¾d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 1d. to 1s. 1½d. Naphthalene, £4 10s. to £9; salts, 55s. to 60s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit; "B" quality, nominally ¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has been little business doing in this article during the past week, but on the whole prices have been maintained. Outside London makes are still quoted at £12 5s. to £12 6s. 3d.; Hull, £12 18s. 9d. to £13; Liverpool, £13 1s. 3d. to £13 2s. 6d.; Leith, £13 2s. 6d.; Middlesbrough, £13.

"**Tar Distiller**" writes under date of the 7th inst.: Inquiries for carbolic acid are very numerous; but the price indicated by buyers is not one which induces business. Solvent naphtha is abundant and difficult to dispose of. Benzol is firm, with a large amount of business passing. There is every indication that pitch has now reached the turning-point again, as several makers are inundated with offers at prices which have been quoted in the journals recently. In view of the information which has come to the writer that a huge quantity of about 40 per cent. more briquettes have been sold for next year's delivery, over and above this year's output, by the largest briquette making country in Europe, it must be very cheering for tar manufacturers, as this, together with the great increase in the road requirements at home, should make the present season a record one. On inquiry there appear to be only one or two manufacturers who have had faith in the present low ideas of prices, and no doubt these firms will now assist the remainder of the distillers in maintaining the good market for pitch which has hitherto prevailed.

The Limavady Urban District Council have before them a report by the Lighting Committee in regard to a proposal to lease the gas-works to Messrs. Anderson Bros. It is to be considered at a special meeting.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade shows a little renewed activity, though the changeable weather interferes to some extent with shipments. In the steam coal trade, there is a fair demand for the next fortnight; but for later delivery, the prices show a little ease. Best Northumbrian steams are about 14s. 9d. per ton f.o.b. for early delivery, with easier prices for next month. Second-class steams are about 13s. 6d. per ton; and steam smalls are weaker at 6s. 3d. to 8s. 6d. per ton f.o.b., according to the quality. Production is steady at present, though there are labour difficulties threatened at some of the collieries. In the gas coal trade, the demand is strong; the consumption being now near its fullest. Best Durham gas coals are about 15s. 6d. per ton f.o.b. for prompt loading, and about 15s. 3d. per ton f.o.b. for loading next month. Second-class gas coals are still at 14s. to 14s. 3d. per ton f.o.b.; while for "Wear specials," from 15s. 6d. per ton f.o.b. is the current quotation. There is little, however, of the latter class free for sale at present. A small contract for gas coals for one of the Italian ports is reported; but new contracts appear to be held back, as some buyers look for lower forward prices. It is worth note in this connection that after three advances in the three ascertainments this year, the Durham miners' wages are, for the quarter now entered upon, unaltered. Gas coke is from 17s. 6d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

During the week there was a stiffening of prices, and orders are in hand for some considerable time ahead. In certain cases the outputs have been restricted, though tonnage is plentiful. On Friday, on the Glasgow Coal Exchange, the following were the approximate current rates: Ell coal, best brands, 13s. to 13s. 3d.; splint, 13s. to 15s. 6d.; Navigations, 15s. to 17s.; steams, 13s. to 14s. 6d.; Hartley, 15s. 3d.; trebles, 13s. 3d. to 13s. 6d.; doubles, 12s. to 12s. 6d.; singles, 10s. 6d. to 11s.; pearls, 9s., and dross, 8s.—f.o.b. Glasgow.

A feature of the Wigan municipal elections was the spirited fight shown in the Swinley Ward by Mr. Robert Alstead, the Liberal candidate, who, while standing for municipal reform, declared that in his opinion real reform did not consist in the starving of the Public Services Department of the Corporation. To save money by cutting down necessary expenditure on street and public lighting, cleansing, &c., was, he said, bad finance, and would most certainly result in a larger outlay later on. Mr. Alstead declared himself in favour of "a real reduction in the price of gas, and the free provision of gas-cookers to all who apply for them." By doing so, he felt sure that Wigan would have a largely increased revenue from its gas undertaking. The candidate, who advocated other improvements in the town's policy, was elected; being the only Liberal to gain a seat. For the first time for nearly half-a-century the Progressive Party in Wigan comes into power, having a majority of two.

What Tradition says:

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Expert Testimony.

Gas-Works, Southport.
18th Sept., 1913.

WILSONS & MATHIESONS, LTD., LEEDS.

GENTLEMEN—I have tested the two Gas Fires you have submitted, and I have obtained the following comparative results:

Your 1912 Fire fitted with fuel of that date gave 51·0 radiation. The same fire fitted with your 1913 Fuel gave 59·7 radiation. Your 1913 Fire fitted with your 1913 Fuel gave **73·1** radiation.—Yours faithfully.

J. BOND.

Progress in Percentages.

			Radiation Result.	Ratio.	Gain.
1912 Fire with	1912 Fuel	. . . .	51·0	100	—
1912 „	„ 1913 Fuel	. . . .	59·7	117	17
1913 „	„ 1913 Fuel	. . . .	**73·1**	143	43

The 1913 Fire which gives this wonderful gain is the **WILSON "SOLA."**

Complete Descriptive List posted on Application to

WILSONS & MATHIESONS, Limited,

CARLTON WORKS, ARMLEY, LEEDS.

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Bye-Product Coke in the United States.

In preceding issues of the "JOURNAL," particulars in regard to the above subject have been given from the report of the United States Geological Survey on "The Manufacture of Coke in 1912." The following are some additional statistics: The value of the coke last year was $42,632,930—an average of $3·84 per ton. The quantity produced in beehive ovens in 1912 was 32,868,435 short tons, valued at $69,103,766, or an average of $2·10 per ton; the difference of $1·74 in favour of the value per ton of beehive coke at the ovens being more than offset by the cost of transportation from the ovens to points of consumption. To the value of the coke produced in retort-ovens must be added the value of the bye-products recovered. This factor in 1912 amounted to $16,070,682, or 38 per cent. of the value of the coke produced. In 1911, the value of the bye-products amounted to $10,033,961, or about 37 per cent. of the value of the coke. The bye-products recovered in 1912 consisted of 54,491,248,000 cubic feet of surplus gas, valued at $4,650,517; 94,306,583 gallons of tar, valued at $2,310,900; and ammonia in the form of sulphate, ammoniacal liquor, or anhydrous ammonia, of a total value of $8,498,713. In addition, there was $610,552 worth of other products, largely coke breeze.

Dublin Gas Company's Labour Trouble.—In connection with the Dublin labour troubles, two vessels arriving at the North Wall with coal for the Alliance and Dublin Gas Consumers' Company were "held up" at the week-end, owing to dockers refusing to work on vessels on which the electric cranes belonging to the Port and Docks Board had to be employed; this refusal being in accordance with a "sympathetic" strike adopted by late employees of the Docks Board. The stoppage of the Gas Company's discharging does not, however, affect the gas-works; the Company having a large supply of coal in stock.

Belfast Gas Committee's Income-Tax.—It was reported at a recent meeting of the Belfast Corporation Gas Committee that an arrangement had been made with the Surveyor of Taxes that the sum on which income-tax for the current year should be assessed would be £43,247; the total amount of deductions for the renewal of buildings, plant, &c., being £46,144. When a minute on the subject was submitted at a meeting of the Corporation, Mr. Riddell said the matter had been very intricate; and they owed the Auditors and their officials—the Manager and Cashier—a debt of gratitude for securing so large a deduction.

Oldbury Gas Undertaking.—The Gas Committee of the Oldbury Corporation, in their report submitted to a meeting of the Urban District Council last Friday, stated that the quantity of gas sent out during the six months ended the 30th of September was 69,661,000 cubic feet, compared with 62,223,000 cubic feet in the corresponding period of last year; being an increase of 7,438,000 cubic feet, or 11·95 per cent. The Committee recommended that £8 8s. should be contributed to the British Commercial Gas Association towards the expenses in connection with the National Gas Exhibition. The report was adopted.

Sale of Stocks and Shares.

The sale conducted by Messrs. A. & W. Richards at the Mart, Tokenhouse Yard, E.C., last Tuesday, included two new issues of capital by order of Directors. The first lots consisted of £5000 of 5 per cent. preference stock of the Southgate and District Gas Company; and it was all sold at £101 to £101 10s. per £100. An issue of £2500 of additional ordinary stock of the same Company, carrying 7 per cent. dividend from the 1st prox., was next submitted; and it was all placed at £131 5s. to £132 per £100. The succeeding lots comprised a new issue of £5 "B" shares and 4½ per cent. debenture bonds of the Romford Gas Company. The shares rank for a standard dividend of 7 per cent. per annum, subject to the sliding-scale; but the dividend on similar shares for the three half years ended the 30th of June last was at the rate of 10½ per cent. per annum They were sold at £9 15s. to £10 apiece, *cum div.* as from the 1st prox. The debenture bonds, amounting to £2000, were for £100 and £50; and they were sold at par. A few £10 fully-paid ordinary shares (maximum dividend 10 per cent.) in the West Surrey Water Company, carrying the above-named dividend, fetched £24 each. By order of executors, £700 of 5 per cent. preference stock of the Brentwood Gas Company was sold at from £100 to £101 15s. per £100, *cum div.* as from the 1st of July last.

The Defective Chandelier Again.—Shortly after half-past five on Monday evening last week, a violent explosion of gas occurred at No. 19, Barker Street, Oldham, occupied by Mr. John Needham, manager of a Royton mill. Mr. Needham wished to put some water into the chandelier in the front sitting-room, and mounted a step-ladder for the purpose. He had a naked light on the table, and he was in the act of pouring in the water when an explosion occurred. He was thrown from the ladder and scorched about the face and arms, and damage was done by fire to the curtains and other articles in the room. He had to be conveyed to the Royal Infirmary, where his injuries were attended to, and he was able to return home.

Slough Gas Company.—The half-yearly general meeting of this Company was held on Monday last week. Mr. R. V. Elvey presided, and, in moving the adoption of the report and accounts, said the shareholders were to be congratulated on obtaining their new Act of Parliament, with valuable additions to the Company's powers, with the least possible amount of friction. The Directors had been able to reduce the price of gas from 3s. 9d. to 3s. 7d. per 1000 cubic feet from Midsummer, and they had every confidence that they would be able to reduce it further to 3s 6d. from the 1st of January next. The several reductions recently made amounted altogether to a gain of £1000 a year by the consumers. During the half year there had been a slight augmentation in the number of ordinary consumers and also of gas fires and cookers on hire. The slot consumers had increased by more than 100. The report and accounts were adopted.

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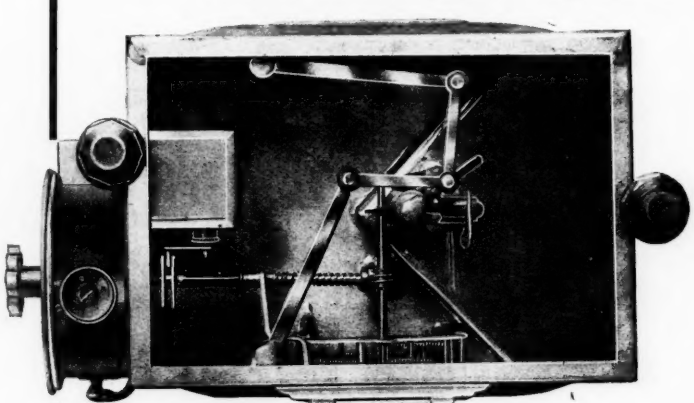
GAS METERS
With Patented Radius Price Changer.



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Manchester Magistrates and Thefts from Slot-Meters.

At the Manchester Police Court last week, a respectably-attired man named Thomas Cuthbert, of Byrom Street, Longsight, was sentenced to six weeks' imprisonment, without the option of a fine, for breaking open a penny-in-the-slot meter and stealing from it cash amounting to 10s. 2d. A sum of 8s. 5d. was found upon the defendant when arrested at a public-house. It was stated that Cuthbert broke open the meter "in a fit of temper," because his wife had rifled his pockets. He promised, however, that he would not repeat the offence, and hoped the Magistrates would look over it. The Court Inspector, however, pointed out that eighteen months ago the defendant had a similar "fit of temper," and was then leniently dealt with. This was the second time he had broken open a meter; and he was liable to three months' imprisonment.

End of the Stockport Gas Strike.

A deputation representing the Stockport branch of the Municipal Employees' Association met a Special Sub-Committee of the Corporation last week, to discuss questions arising out of the recent strike settlement. The matter principally dealt with was the re-instatement of the few men who had not been found work. In the end, it was announced that the Committee guaranteed that work would be found in other departments for the men who were not re-instated. All would be given employment, and there would be no victimization. The non-unionist question was also considered; and the demand for the dismissal of the non-unionists at the gas-works was withdrawn. The subject of the intimidation of these men was also gone into fully on both sides, with the result that the deputation gave an undertaking that the terms of settlement—which expressly stipulate that there shall be no interference with the non-unionists—would be loyally observed by the local members of the Association. The General Secretary of the Union (Mr. P. J. Tevenan) afterwards declared that he considered the final settlement satisfactory, and did not anticipate any further trouble. He hoped the future relations between the parties would be harmonious.

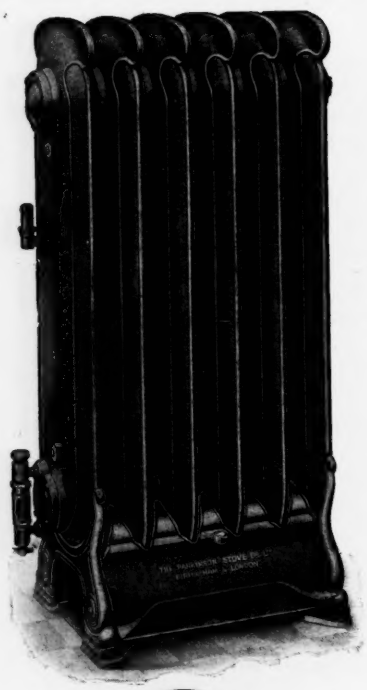
Howth Water and Sewerage Improvements.—Mr. A. D. Price, Engineering Inspector under the Irish Local Government Board, recently held an inquiry into an application by the North Dublin District Council for the Board's sanction to a loan of £3250 for the carrying-out of additional water and sewerage works at Howth; the scheme to be supplemental to that already completed in the upper portion of the town. The estimate of the Council's Engineer (Mr. P. H. M'Carthy) was: For water mains, £341 12s.; sewerage works, £2909 16s. Mr. J. Conroy, Assistant Clerk of the Union, said the cost of the previous scheme was £17,500. The repayment of the proposed loan would amount for the first year, in principal and interest, to over £221, or ⅛d. in the pound on the whole district. There was no opposition.

Allocation of Gas Profits at Bury.

Councillor Samuel Kay, the Chairman of the Bury (Lancs.) Corporation Gas Committee, who was returned at the head of the poll last week in connection with the local municipal elections, told a meeting of his supporters that perhaps some people thought the Gas Department was making too much profit out of the consumers. The Committee, of which he had been Chairman now for some years, had succeeded in making a profit of about £10,000, one-half of which had gone back to the consumers, and the other half in the reduction of rates. The £5000 had helped to keep the rates lower to the extent of from 4d. to 5d. in the pound. It did not follow, because they had made this amount of profit, that they had made it out of an excessive price for gas. The Gas Committee were not unreasonable in their charges; but, at the same time, he believed improvements had yet to be made in connection with their gas, and the question of price would certainly be considered. It was the wish of the Committee to sell gas at a reasonable price, and not make excessive profits. For some time, he had been of opinion that people who used gas-fires should be supplied either on hire or on the three years' hire-purchase system. He hoped, shortly, to announce an alteration in the principle of charging meter-rents. Charging for the loan of a meter was looked upon by many people as having to pay so much a quarter for the measuring of the gas they used.

The United Gas-Works Development Company.—Under this title a company was registered on Oct. 29, with a capital of £2000 in £1 shares. The first Directors are Mr. H. D'Aeth, of No. 31, New Bond Street, and Mr. Frederick Colman, of No. 14, Victoria Street, S.W. There are seven signatories taking one share each; and it is provided that the Directors may proceed to allotment on a subscription of seven shares. The offices are at No. 14, Victoria Street. It may be pointed out that in our issue of Oct. 28 (p. 283), reference was made to a Company similarly styled in connection with the prospectus of the Somerset and Gloucester Gaslight and Coke Company, Limited, whose scheme, it was then stated, had collapsed owing to the intervention of the Bristol Gas Company.

Dangers of Defective Gas-Fittings.—Owing to a defective gas-tap, Frank Robinson, a forgeman in the employ of Messrs. Ruston, Proctor, and Co., of Lincoln, died from gas poisoning a few days ago. At the inquest last Wednesday, it was stated by the landlord of the house in which deceased lived that when he went to the bedroom to call him for dinner the room was full of gas, and Robinson was lying upon his bed unconscious. The gas-tap had no stop to it, and was loose, and it was turned about three-quarters on. The Jury returned a verdict of "Accidental death;" and the Coroner said he could not help thinking that the public generally should be warned as to the danger of defective gas-fittings. A tap often, in the course of two or three years' working, became a little defective.



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Prices and full particulars on application.

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BIRMINGHAM & LONDON.

Nottingham Gas-Workers' Threatenings.

Though with the settlement of the strike affecting the tinsmiths connected with the meter repairing shops of the Nottingham Corporation, it had been hoped that troubles among the employees of the Gas Committee were at an end, expectations on this score have not been realized. Last week witnessed a recrudescence of agitation in an acute form, threatening to bring within its train difficulties upon a more extended scale. Following upon the recent settlement, the Union of Gas Workers now threaten to take the field in opposition to the alleged continued employment by the Gas Committee of so-called blackleg labour. Repairing work was kept going at the Woodborough depôt during the whole of the period of the strike; and to facilitate the process, certain hands, previously employed in the general work, were brought in. Following upon the resumption of work by the tinsmiths, employment has to be found for these men who remained loyal to the Committee at a difficult juncture; and from the allocation to them of new places in the service the fresh trouble has arisen. The declaration is that under no circumstances will the Union permit their members to work with those who are to be ostracised for having dared to run counter to trade union methods. There is no reason to anticipate, though the force arrayed may be relatively of a much more formidable character, that the Committee's attitude in the matter will differ in any material degree from that hitherto adopted. The local Executive of the National Union has, it is understood, already been entrusted with power by the central authority to ballot the general body of workers on the main question involved; and it is suggested that a Sub-Committee of the Executive Council may shortly hold a special meeting in Nottingham to deal with the situation. Meanwhile, the circulation of reports that the men who remained loyal to the Gas Committee have been rewarded by substantial bonuses has not tended to soften asperities.

Gas-Works and Vegetation.—The decision in the Conway Gas-Works nuisance case, reported in last week's issue, has attracted the attention of Colonel Paterson, of Penmaenmawr, with the result that he has written to his own Urban District Council urging them, in view of this judgment, to take steps to abolish what he describes as a public nuisance. He alleges that "the smell emanating from the gas-works is most offensive, and the fumes very destructive to vegetation." The Colonel's opinions are evidently not unanimously shared in the locality; for the Chairman remarked that he would advise him to take the same action as Mr. Wood had done at Conway, and the Clerk was instructed to write informing him that the Council could not interfere in the matter.

The Helm Lamp Company, of Nuneaton, have sent in their latest catalogue of lamps, mantles, and accessories.

We have received from Messrs. D. Hulett and Co., Limited, of High Holborn, W.C., their complete illustrated catalogue (No. 160) of gas-fittings. It occupies 176 large quarto pages.

At an extraordinary general meeting of the British Coalite Company, Limited, last Thursday, the resolutions in connection with the reorganization scheme passed at a previous meeting [*ante*, p. 365] were agreed to without discussion.

The boom in gas-fires at Oldham still continues. At a meeting of the Gas and Water Committee last week, the General Manager (Mr. Arthur Andrew) reported that during the fortnight 193 orders had been given, against 134 the previous fortnight, and 92 a month ago.

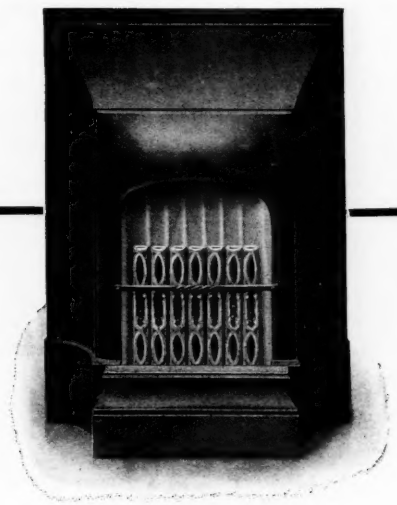
The Trades Exhibition (which last year attracted 50,050 visitors) was opened last Wednesday at the Connaught Hall, Portsmouth; and among the many inventions and goods, the Portsea Island Gas Company showed for the first time a new 1500-candle power high-pressure lamp, automatic switches for ordinary incandescent burners, gas-fires, and cooking-stoves.

A new service reservoir of a capacity of 500,000 gallons has been built at Newport (Mon.) by Messrs. Cowling and Son, of Bristol, from the plans of the Borough Water Engineer (Mr. T. Tremelling); the outlay having been £3500, against an estimated cost of £3900. Water was turned into the reservoir last Wednesday by the Mayor (Mr. C. P. Simmonds), who was presented by Mr. Cowling with a silver casket.

Serious complaints were made last Tuesday, at the meeting of the Fareham Urban District Council, of the gas supplied by the Fareham Gas Company. One member remarked that the supply was "abominable" and a second speaker corroborated, and pressed for an immediate test by an expert. The Chairman, however, pointed out that notice would have to be given before a test could take place; and the matter was eventually referred to the Lighting Committee.

At a meeting of the Belfast Corporation on Monday last week, Alderman Craig, in moving the adoption of the Gas Committee's minutes, drew attention to the report of the deputation to the National Gas Congress and Exhibition at Shepherd's Bush, and to the aims and objects of the organizers. He asked the members of the Council to read the report carefully, as it furnished much interesting information as to the gas industry, and could not but be of great value to the Municipality.

Last Thursday, the Lord Mayor of Manchester, Sir Walter Royse (head of the firm of S. W. Royse and Co.), entertained his employees at dinner in the Town Hall; and afterwards Mr. Norton, on behalf of the staff, presented Sir Walter and Lady Royse with a handsome solid silver loving cup, bearing the following inscription: "To congratulate Sir Walter and Lady Royse on their success as Lord Mayor and Lady Mayoress of Manchester, November, 1911, to November, 1913. From the staff at No. 20, Albert Square." The gift was accompanied by an address, in which the staff congratulated Sir Walter Royse on the honour of knighthood which has been conferred upon him—a distinction which, it was added, is appreciated by the whole community.



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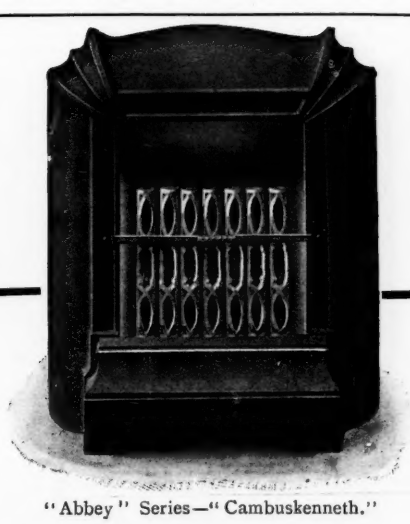

"Abbey" Series—"Cambuskenneth."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ASSISTANT ENGINEER AND SUPERINTENDENT. No. 5811.
JUNIOR ASSISTANT TO ENGINEER. East Hull Gas Company.
MAINLAYER. Cleethorpes Gas-Works.
GAS-FITTERS. Aldershot Gas Company.
MAINTENANCE INSPECTOR. Aldershot Gas Company.
TRAVELLER. No. 5807.
CONDUCT OF LONDON OFFICE. No. 5806.
MECHANIC. No. 5808.

Appointments, &c., Wanted.

REPRESENTATIVE (Fittings and Apparatus). No. 5812.

Agency Wanted.

GAS-METERS. No. 5810.

Gas-Works Wanted.

D.G., c/o Scripps's Advertising Offices.

Plant, &c. (Second Hand), for Sale.

RETORTS AND MOUTHPIECES. Newcastle-on-Tyne Gas Company.
STATION METERS AND GOVERNORS. No. 5801.

Plant, &c. (Second Hand), Wanted.

GAS COMPRESSORS. "S.," c/o Milton's Advertising Agency.
TEST ROOM GASHOLDER. No. 5805.

Meeting.

ORIENTAL GAS COMPANY. Finsbury House, E.C. Nov. 26. Twelve o'clock.

Stocks and Shares, Sales of.

ALDERSHOT GAS, &c., COMPANY. London Mart. Nov. 18.
BOGNOR GASLIGHT COMPANY. London Mart. Dec. 2.
BOGNOR WATER COMPANY. London Mart. Nov. 18.
BRENTWOOD GAS COMPANY. London Mart. Dec. 2.
GRAYS AND TILBURY GAS COMPANY. London Mart. Dec. 2.
HARROW AND STANMORE GAS COMPANY. London Mart. Dec. 2.
PINNER GAS COMPANY. London Mart. Nov. 18.
SOUTHEND WATER COMPANY. London Mart. Dec. 2.
TITCHFIELD GAS COMPANY. London Mart. Nov. 18.
WANDSWORTH, &c., GAS COMPANY. London Mart. Nov. 25.

TENDERS FOR

Benzol.

BRIDGEWATER COLLIERIES COKE-WORKS. Tenders by Nov. 24.

Coal.

GOOLE URBAN DISTRICT COUNCIL. Tenders by Nov. 19.

Oxide.

WARRINGTON GAS DEPARTMENT. Tenders by Nov. 17.

Pipes, &c.

LYMM URBAN DISTRICT COUNCIL. Tenders by Nov. 20.

Retort-Bench Fittings, Mains, Mouthpieces, &c.

SHEFFIELD GASLIGHT COMPANY. Tenders by Dec. 2.

Tar and Liquor.

NEWBURY GAS DEPARTMENT. Tenders by Nov. 17.
TAMWORTH GASLIGHT COMPANY. Tenders by Nov. 15.

GAS COMPANIES' STOCK AND SHARE LIST.

The leading markets in the Stock Exchange last week were free from any violent perturbations; but the dominant factors in public affairs were still of a character adverse to any revival of activity or any disposition to regard things with a glad eye. They may be briefly summed up in Mexican troubles abroad and labour unrest at home. The markets mostly showed some falling-off in prices at the close; but one or two ephemeral rays of sunshine in the course of the week rallied them occasionally. The opening on Monday was quite gloomy. Mexico was the storm centre; and the far-reaching depression affected all markets. There was not much doing, but prices all round were discreetly lowered. Consols fell $\frac{1}{8}$; while Rails, Transatlantics, and Foreign all gave way. A failure was announced. Tuesday opened with similar conditions ruling; the Mexican cloud brooding over markets in general. Gilt-edged were dull, Rails were offered freely, and Transatlantics pressed for sale on Continental account. In the afternoon, markets turned round, and "bears" were busy buying back; but the recovery was not complete. Wednesday brought no quickening-up of business, but a decided improvement in tone. Gilt-edged were firm, Rails were encouraged to make some small advances, and American were stronger. Thursday was very quiet, but the tendency was fair. Government issues were steady, and Rails rather better; but Transatlantics were being sold from abroad. On Friday, things were very unpromising at first—the Mexican aspect not being liked at all; and prices gave way generally. After awhile, however, the wind began to blow from the opposite quarter, and almost all recovered partially, though not wiping out all their losses. Consols went down $\frac{1}{8}$. Rails showed some shrinkage, and American had an almost general fall. Saturday was very quiet but steadier. All departments were extremely inactive, but not disposed to fall. Consols closed without further change at $72\frac{1}{2}$ to $72\frac{3}{4}$—a fall of $\frac{1}{4}$ in the week. The Money Market was well supplied for all demands, and rates were easier. Business in the Gas Market amounted to a moderate aggregate, but was very closely limited to a few prominent undertakings. Only ten ewere dealt in at all; and some of these had but a single transaction recorded in them. Gaslight and Coke issues outstripped all the rest put together. In the ordinary, there was a nice demand, and the price (which opened at $101\frac{1}{2}$) ran up to 103 before the close—a rise of $\frac{1}{2}$. The secured issues were also pretty busy; the maximum changing hands at 74 to $75\frac{3}{4}$, the preference at $93\frac{1}{2}$ to $94\frac{1}{2}$, and the debenture at $72\frac{3}{4}$ to $73\frac{1}{4}$. South Metropolitan was quiet and unchanged at 108 to $109\frac{1}{2}$; and the debenture made $73\frac{1}{4}$ to 74—a fall of 1. In Commercials, the 4 per cent. realized $106\frac{7}{8}$, and the $3\frac{1}{2}$ per cent. 103 and $103\frac{1}{8}$. Among the Suburban and Provincial group, South Suburban fetched $115\frac{3}{4}$, and Tottenham "B" 115. In the Continental companies, Imperial was active, and marked 165 to $166\frac{1}{2}$, ditto debenture was done at 84, Union at 79, ditto preference at $125\frac{1}{2}$, and European at $17\frac{1}{2}$ to 18. Among the undertakings of the remoter world, a small parcel of Oriental was sold free at 124, Primitiva marked $5\frac{7}{8}$ to $6\frac{1}{8}$, ditto preference $4\frac{7}{8}$ and $4\frac{15}{16}$, and ditto debenture 93.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 15	4	Alliance & Dublin Ord.	58–63	..	6 7 0
374,000	,,	July 11	4	Do. 4 p.c. Deb.	80–83	..	4 16 5
280,000	5	Oct. 15	7½	Bombay, Ltd.	6¼–6¾	..	5 17 8
50,000	10	Aug. 28	15	Bourne-mouth Gas and Water { 10 p.c. B 7 p.c. Pref. 6 p.c.	28½–29½	..	5 2 2
347,500	10	,,	7		14⅞–15½	..	4 11 10
75,000	10	,,	6		13¾–13⅞	..	4 7 3
880,000	Stk.	Aug. 14	14	Brentford Consolidated	262–267	..	5 4 10
330,000	,,	,,	11	Do. New	202–207	+1	5 6 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	111–113	..	4 8 6
206,250	,,	June 13	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
217,880	Stk.	Aug. 28	11	Brighton & Hove Orig.	201–206	..	5 6 10
244,200	,,	,,	8	Do. A Ord. Stk.	149–152	..	5 5 3
630,000	20	Sept. 26	12½	British	44½–45½	..	5 9 11
120,000	Stk.	June 27	4	Do. 4 p.c. Deb. Stk.	87–89	..	4 9 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	89½–91½	..	4 7 5
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	3–5	..	—
100,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	75–80	..	5 12 6
157,150	Stk.	Aug. 14	5	Chester 5 p.c. Ord.	109–111	..	4 10 1
1,513,280	Stk.	Aug. 28	5/9/4	Commercial 4 p.c. Stk.	105–107	..	5 2 1
560,000	,,	,,	5½	Do. 3½ p.c. do.	102–104	..	5 2 6
475,000	,,	June 13	8	Do. 3 p.c. Deb. Stk.	71½–73½	..	4 1 8
800,000	Stk.	,,	4½	Continental Union, Ltd.	79–82	..	5 9 9
200,000	,,	,,	?	Do. 7 p.c. Pref.	124–126	..	5 11 1
492,270	Stk.	—	£3	Derby Con. Stk.	123–125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	102–104	..	3 16 11
1,002,180	10	July 30	10	European, Ltd.	17½–18½	..	5 8 1
16,386,660	Stk.	Aug. 14	4/17/4	Gas-light { 4 p.c. Ord. 3½ p.c. max.	101–103	+½	4 14 7
2,600,000	,,	,,	3½		74–77	..	4 10 11
4,062,235	,,	,,	4	and Coke { 4 p.c. Con. Pref. 3 p.c. Con. Deb.	93–96	..	4 3 4
4,674,850	,,	June 13	3		73–74	..	4 1 1
258,740	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	87–89	..	5 12 4
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 15	11	Hongkong & China, Ltd.	16⅞–17⅛	..	6 7 6
131,000	Stk.	Sept. 11	7⅛	Ilford A and C	150–153	..	4 19 8
65,780	,,	,,	6⅛	Do. B	118–120	..	5 2 1
65,500	,,	June 27	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
4,940,000	Stk.	May 16	9	Imperial Continental	163–168	..	5 7 2
1,235,000	Stk.	Aug. 14	8½	Do. 3½ p.c. Deb. Red.	83½–85½	..	4 1 10
200,242	Stk.	Aug. 28	6½	Lea Bridge Ord. 5 p.c.	118–121	..	5 3 4
561,000	Stk.	,,	10	Liverpool United A	206–208	..	4 16 2
718,100	,,	,,	7	Do. B	145–147	−2	4 15 3
306,083	,,	June 27	4	Do. Deb. Stk.	94–96	..	4 3 4
63,480	Stk.	June 27	3	Maidstone 3 p.c. Deb.	66⅛–68⅛	..	4 7 7
75,000	5	June 13	6	Malta & Mediterranean	4⅜–4⅝	..	6 3 1
250,000	100	Oct. 1	4½	Met. of Melbourne { 4½ p.c. Deb.	96–98	..	4 11 10
541,920	20	May 30	4	Monte Video, Ltd.	12–12½	..	6 8 0
1,775,892	Stk.	July 20	4½	Newc'tle&G'tesh'd Con.	99½–100	..	4 10 0
529,705	Stk.	June 27	3½	Do. 3½ p.c. Deb.	83½–84½	..	4 2 10
55,940	10	Aug. 28	7/10/6	North Middlesex 7 p.c.	12½–13¼	..	5 11 5
300,000	Stk.	May 16	8	Oriental, Ltd.	124–129	..	6 4 0
60,000	5	Sept. 26	10	Ottoman, Ltd.	8–8½	..	5 17 8
60,000	50	Aug. 14	13	Portsea, Island B	122–125	..	5 6 1
100,000	50	,,	12	Do. C	119–122	..	4 18 4
249,980	5	Oct. 15	8	Primitiva Ord.	5⅞–6⅛	−⅛	6 8 0
499,960	5	June 27	5	,, 5 p.c. Pref.	4⅞–5⅛	..	4 17 7
521,600	100	June 2	4	,, 4 p.c. Deb.	93–95	..	4 4 3
346,198	Stk.	June 27	4	River Plate 4 p.c. Deb.	89–91	..	4 7 11
275,000	5	Sept. 26	12	San Paulo, Ltd.	—	..	—
150,000	10	,,	6	Do. 6 p.c. Pref.	11–11½	..	5 4 4
125,000	50	July 1	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
135,000	Stk.	Aug. 28	10	Sheffield A	222–224	..	4 9 8
209,984	,,	,,	10	Do. B	221–223	−1	4 9 8
523,500	,,	,,	10	Do. C	220–222	−⅛	4 10 1
90,000	10	Oct. 15	7⅛	South African	9½–10½	..	7 2 19
6,429,895	Stk.	Aug. 14	5/9/4	South Met., 4 p.c. Ord.	108–110	..	4 19 4
1,895,445	,,	July 11	3	Do. 3 p.c. Deb.	72–74	−1	4 1 1
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	157–159	..	5 6 11
952,795	Stk.	,,	6	S'th Suburb'n Ord. 5 p.c.	115–117	..	5 2 7
60,000	,,	,,	5	Do. 5 p.c. Pref.	113–115	..	4 6 11
117,058	,,	June 27	5	Do. 5 p.c. Deb. Stk.	115–117	..	4 5 6
594,740	Stk.	May 16	5	Southampton Ord.	102–105	..	4 15 3
120,000	Stk.	Aug. 14	7⅜	Tottenham and { A 5 p.c. B 3½ p.c.	136–139	..	5 6 1
543,940	,,	,,	5⅝		114–116	..	5 1 3
149,470	,,	June 27	4	Edmonton { 4 p.c. Deb.	90–92	..	4 7 0
182,380	10	,,	5	Tuscan, Ltd.	5–6	..	8 6 8
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96–98	..	5 2 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	111–113	..	4 8 6
30,000	Stk.	Aug. 28	8⅜	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	155–160	..	5 4 8
255,636	,,	,,	6⅝	,, B 3½ p.c.	130–135	..	5 1 10
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110–115	..	5 2 0
352,000	,,	,,	6⅛	Wimbledon 5 p.c.	111–116	..	5 5 7
98,000	,,	,,	6⅜	Epsom 5 p.c.	115–120	..	5 10 5
88,416	,,	June 27	3	3 p.c. Deb. Stk.	68–70	..	4 5 9